

Date:	DOCUMENT REVIEW	Document Name: Former Myrtle Beach Air Force Base, Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
27, January 2017	TO 177 – Perfluorinated Compounds (PFCs) Release Determination, Delineation and Remediation at Multiple BRAC Bases; FA8903-08-D-8766	Document Date: January 2017

<i>IR FORCE TECHNICAL REVIEW COMMENT MATRIX</i>					
<i>Item</i>	<i>Page</i>	<i>Section</i>	<i>Line(s)</i>	<i>Comments</i>	<i>Response to Comment (Aerostar SES LLC)</i>
Reviewer: Ms. Meredith Amick, SCDHEC					
1.				The Department looks forward to receiving the boring and well installation request for the upcoming field work.	Agree. The boring and well installation request will be submitted during the week of February 13, 2017.
2.		QAPP Worksheet 10	Table 1	Please discuss the proximity of Area 8 to Building 505 (SWMU 78/80).	Agree. The following bullet has been added to Worksheet 10: <ul style="list-style-type: none"> AFFF Area 8 lies up-gradient and east of the Building 505 (SWMU 79/80) LUC Boundary.
3.		QAPP Worksheet 17	Water Well Survey	Please notify the Department before public contact is made for the water well survey. The Department would like to be part of this effort.	Agree. Should it become necessary to contact the public concerning private water wells, ASL will contact the Department prior to initiating that portion of the well survey.
4.		QAPP Worksheet 17	Table 2	Please note the Site/SWMUs that the existing wells are associated with on this table.	Agree. Table 2 has been updated to include the associated Site Names/SWMUs.
5.		Figure 4		The text states that OS40RW5 will be sampled as part of Area 8; however, this well is not shown on Figure 4. Please add this well to the figure.	Agree. Monitoring well OS40RW5 has been added to Figure 4.
6.		All Figures		Please identify and label SWMU boundaries for all SWMUs within the displayed area. This is of particular importance for SWMU 40 and SWMU 78/80 whose plumes are shown.	Agree. All figures have been updated to show SWMU boundaries.

FINAL
**INSTALLATION-SPECIFIC
UNIFORM FEDERAL POLICY–
QUALITY ASSURANCE PROJECT PLAN ADDENDUM**

FORMER MYRTLE BEACH AIR FORCE BASE

**SITE INSPECTION OF POTENTIAL PERFLUORINATED COMPOUND
RELEASE AREAS AT MULTIPLE BRAC INSTALLATIONS**

February 2017

Prepared for:



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**Contract No. FA8903-08-D-8785
Task Order No. 0017**

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Table of Contents

Acronyms and Abbreviations.....	v
INTRODUCTION.....	1
QAPP Worksheet #1 & 2: Title and Approval Page	7
QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution	8
QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet	9
QAPP Worksheet #6: Communication Pathways	10
QAPP Worksheet #9: Project Planning Session Summary.....	11
QAPP Worksheet #10: Conceptual Site Model.....	13
QAPP Worksheet #11: Project/Data Quality Objectives	18
QAPP Worksheet #12: Measurement Performance Criteria	20
QAPP Worksheet #13: Secondary Data Uses and Limitations	21
QAPP Worksheet #14/16: Project Tasks & Schedule	23
QAPP Worksheet #15: Action Limits and Laboratory-Specific Detection/Quantitation Limits	25
QAPP Worksheet #17: Sampling Design and Rationale	26
QAPP Worksheet #18: Sampling Locations and Methods	33
QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times	42
QAPP Worksheet #20: Field QC Summary Field QC Summary	43
QAPP Worksheet #21: Field SOPs	44
QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection	45
QAPP Worksheet #23: Analytical SOPs.....	46
QAPP Worksheet #24: Analytical Instrument Calibration.....	47
QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection	48
QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal.....	49
QAPP Worksheet #28: Analytical Quality Control and Corrective Action	50
QAPP Worksheet #29: Project Documents and Records.....	51
QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action	52
QAPP Worksheet #34: Data Verification and Validation Inputs	53
QAPP Worksheet #35: Data Verification Procedures.....	54
QAPP Worksheet #36: Data Validation Procedures.....	55
QAPP Worksheet #37: Data Usability Assessment.....	56
REFERENCES.....	57

List of Tables

Table 1 Conceptual Site Model Summary	14
Table 2 Perfluorinated Compound Sampling Strategy and Rationale at the Former Myrtle Beach Air Force Base	31

List of Figures

Figure 1 Site Location Map
Figure 2 Installation Overview Map
Figure 3 AFFF Areas 1, 2, 3, 4, 5, and 9 Proposed Sample Locations
Figure 4 AFFF Areas 6, 7, and 8 Proposed Sample Locations
Figure 5 AFFF Area 9 Proposed Sample Locations
Figure 6 AFFF Areas 10 Flightline Proposed Sample Location

List of Appendices

Appendix A	Installation-Specific Health and Safety Considerations
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Acronyms and Abbreviations

~	approximately
<	less than
>	greater than
µg/L	micrograms per liter
AFB	Air Force Base
AFBCA	Air Force Base Conversion Agency
AFCEC	Air Force Civil Engineer Center
AFFF	aqueous film forming foam
APP	accident prevention plan
AMEC	AMEC Foster Wheeler Environment and Infrastructure, Inc.
ASL	Aerostar SES LLC
BA	Bachelor of Art
BEC	base environmental coordinator
bgs	below ground surface
BRAC	Base Realignment and Closure
BS	Bachelor of Science
CB&I	CB&I Federal Services, LLC
CIH	Certified Industrial Hygienist
CNTS	Cherokee Nation Technology Solutions
COPC	contaminant of potential concern
COR	Contracting Officer Representative
CPR	cardiopulmonary resuscitation
CSM	conceptual site model
CSP	Certified Safety Professional
dB	decibels
dba	A-weighted decibels
DO	dissolved oxygen
DoD	Department of Defense
DoDI	Department of Defense Instruction
DPT	Direct Push Technology
DQO	data quality objective
EC	emerging contaminant
ELAP	Environmental Laboratory Accreditation Program
EPA	Environmental Protection Agency
eV	electron volt
FOLTA	Forward Operating Location Training Area
ft	foot/feet
FL	Florida
GA	Georgia
FTA	fire training area
HA	health advisory
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSO	Health and Safety Officer
HSP	health and safety plan
ID	identification
IDW	investigation-derived waste
kg	kilograms
LC-MS/MS	liquid chromatography and tandem mass spectrometry
LSS	Licensed Soil Scientist

MBIA	Myrtle Beach International Airport
mg/kg	milligrams per kilogram
mg/m ³	milligrams per cubic meter
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
NC	North Carolina
N-EtFOSAA	N-Ethyl perfluorooctanesulfonamidoacetic acid
N-MeFOSAA	N-Methyl Perfluorooctanesulfonamidoacetic acid
NRR	noise reduction rating
ORP	oxidation reduction potential
PA	preliminary assessment
PE	proficiency evaluation
PEL	permissible exposure limits
PFBS	perfluorobutanesulfonic acid
PFDA	perfluorodecanoic acid
PFDaA	perfluorododecanoic acid
PFC	perfluorinated compounds (also referred to as perfluorinated chemicals)
PFHpA	perfluoroheptanoic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexanesulfonic acid
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFTA	perfluorotetradecanoic acid
PFTTrDA	perfluorotridecanoic acid
PFUnA	perfluoroundecanoic acid
PG	Professional Geologist
pH	potential of hydrogen
PID	photoionization detector
POC	point of contact
PPE	personal protective equipment
ppm	parts per million
PVC	polyvinyl chloride
QAPP	quality assurance project plan
QC	quality control
QPP	quality program plan
QSM	quality systems manual
SCDHEC	South Carolina Department of Health and Environmental Control
SI	site inspection
SOP	standard operating procedure
SWMU	Solid Waste Management Unit
TAC	Tactical Air Command
TBD	to be determined
TLV	threshold limit value
TN	Tennessee
UFP	uniform federal policy
USAF	United States Air Force
VOC	volatile organic compound
WWII	World War II

INTRODUCTION

This installation-specific uniform federal policy (UFP)-quality assurance project plan (QAPP) addendum presents the methodologies and procedures for conducting perfluorinated compound (PFC) site inspection (SI) activities at the former Myrtle Beach Air Force Base (AFB) (Figure 1). This project is being conducted by the United States Air Force (USAF), under the USAF Environmental Restoration Program (USAF, November 2014), to assess the presence or absence of PFCs at 10 potential aqueous film forming foam (AFFF) areas (Figure 2). These 10 AFFF areas were documented in the preliminary assessment (PA) as locations where AFFF containing PFCs may have been released to the environment (AMEC Foster Wheeler Environment and Infrastructure, Inc. [AMEC], December 2015).

Per Department of Defense Instruction (DoD) 4715.18, “Emerging Contaminants (ECs)” (DoD, June 2009), Air Force Instruction 32-7020 (USAF, November 2014), and the *Interim USAF Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and Base Realignment and Closure (BRAC) Installations* (USAF, August 2012), in the absence of an applicable legal driver, the USAF may confirm a possible release of an EC, such as PFCs, followed by delineation if

- a reasonable basis exists to suspect a potential release associated with Air Force activities at an installation,
- an exposure pathway exists for the probable contamination to threaten public health, and/or
- the potential for off-site migration is likely.

Following this instruction and the USAF *Policy on Perfluorinated Compounds of Concern* USAF, August 2016a), this quality program plan (QPP) has been developed to guide the SI process for PFCs at the former Myrtle Beach AFB. This document is provided as an addendum to the general UFP-QAPP presented within the QPP (Aerostar SES LLC [ASL], May 2016) and has been prepared under Contract No. FA8903-08-D-8785, Task Order 0017. Combined, this addendum and the general UFP-QAPP have been prepared to ensure

- the data quality objectives (DQOs) for this project are clearly identified,
- the field sampling protocols are documented and reviewed consistently, and
- the data collected are scientifically valid and defensible.

This UFP-QAPP addendum includes specific worksheets to accompany the general QPP and installation-specific health and safety plan (HSP) information. The following QAPP worksheets represent necessary site-specific updates to address the activities to be conducted at the former Myrtle Beach AFB. Where appropriate, the general UFP-QAPP has been referenced and information is not duplicated.

PROJECT OBJECTIVES

The primary objective of the SI at the former Myrtle Beach AFB is to investigate AFFF Areas 3 through 10, previously identified as part of the PA (AMEC, December 2015), and

- determine if PFCs are present in groundwater and/or soil;
- determine if concentrations of perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA), or a sum of both in groundwater exceed the United States Environmental Protection Agency (EPA) health advisory (HA) of 0.07 micrograms per liter (µg/L) (EPA, 2016b and 2016c);
- identify potential human health pathways and receptors; and
- where there is a reasonable expectation that PFOA and/or PFOS may be present in groundwater, determine if drinking water wells are impacted.

PERFLUORINATED COMPOUNDS OVERVIEW

PFCs are a class of synthetic compounds formed from carbon chains with fluorine attached. The chemical structure of PFCs gives them unique properties, such as thermal stability and the ability to repel both water and oil, that make them useful components in a wide variety of consumer and industrial products, including nonstick cookware, food packaging, waterproof clothing, fabric stain protectors, lubricants, paints, and firefighting foams such as AFFF. AFFF concentrate contains fluorocarbon surfactants to meet required performance standards (DoD, August 1994). The surfactants provide AFFF with the low surface tension needed to enable film formation on top of the fuel to help suffocate the fire.

Several federal government documents confirm the initial use of AFFF by the USAF beginning in 1970:

- Military Specification for AFFF (MIL-F-24385), formally issued in 1969 (DoD, November 1969);
- General Accounting Office determination on sole source award protest to provide AFFF to the Navy in December 1969; and
- *A History of USAF Fire Protection Training at Chanute Air Force Base, 1964-1976* (Coates, 1977).

The USAF began purchasing and using AFFF containing PFCs (PFOS and/or PFOA) for extinguishing petroleum fires and firefighting training activities in 1970 (USAF, August 2012). AFFF was primarily used at USAF installations in and around fire training areas (FTAs). AFFF was also stored, released, and disposed of at multiple locations throughout the installations.

The United States EPA Office of Water issued provisional health advisories (PHAs) for PFOS (0.2 micrograms per liter [$\mu\text{g/L}$]) and PFOA (0.4 $\mu\text{g/L}$) in 2009 to protect humans from potential risk of exposure to these chemicals through drinking water (EPA, January 2009). The EPA Office of Water issued lifetime drinking water Health Advisories (HAs) for PFOS and PFOA in May 2016 that replace the 2009 PHA values (EPA, May 2016a). The HAs for PFOS and PFOA are 0.07 $\mu\text{g/L}$ for each constituent. When PFOA and PFOS co-occur at the same time and location in a drinking water source, a conservative and health-protective approach that EPA recommends is to compare the sum of the concentrations (PFOA + PFOS) to the HA (0.07 $\mu\text{g/L}$). HAs identify the concentration of a contaminant in drinking water at which adverse health effects are not anticipated to occur over specific exposure durations (e.g., one day, 10 days, a lifetime). They serve as informal technical guidance to assist federal, state, and local officials, and managers of public or community water systems in protecting public health when emergency spills or other contamination situations occur. HA values are not to be construed as legally enforceable federal standards and are subject to change as new information becomes available (EPA, May 2016a).

The United States EPA has not established advisory levels for concentrations of PFOS and PFOA in surface water, soil, or sediment. In addition, the State of South Carolina does not have any state-specific advisory levels or regulations regarding the presence of PFOS and PFOA in groundwater, surface water, soil, or sediment.

INSTALLATION-SPECIFIC BACKGROUND

Myrtle Beach AFB was originally constructed as a municipal airport for the city of Myrtle Beach and incorporated into the Army Air Corps in 1941 (Figure 1). The base was known as the Myrtle Beach Gunnery and Bombing Range during the first half of World War II (WWII) and encompassed over 5,000 acres used for combat training (Air Force Civil Engineer Center [AFCEC], December 2016). It was home to the 323rd and 391st Bombardment groups, 404th Fighter group, and the 304th Fighter Squadron. The base was renamed the Myrtle Beach Army Air Field in 1943, during which time extensive new construction took place and the installation expanded.

The base was returned to the city of Myrtle Beach in 1947 at the end of WWII, but reinstated in 1954 with the onset of the Cold War. The installation aligned with the Tactical Air Command (TAC), and replaced

the majority of the WWII facilities with new construction to house the 354th Tactical Fighter Wing. The installation joined with the city of Myrtle Beach in the mid-1970s when a civilian airport was developed on its northeastern side and became annexed into the City in 1977 (WPI, Inc., June 1996).

Myrtle Beach AFB closed pursuant to the Defense Base Realignment and Closure Act (BRAC) on March 31, 1993, and all base property has been transferred to City, County, and private entities. The airfield portion of the base was transferred to the Myrtle Beach International Airport (MBIA), an Horry County-operated facility.

Myrtle Beach AFB maintained its own independent water supply through four wells (Wells #1, #2, #3, and #5) located at the installation. These wells were constructed to depths of approximately 800 feet below ground surface (bgs) into the Peedee and Black Creek Aquifers (AMEC, 2015). Myrtle Beach AFB and the surrounding area utilized deep groundwater wells developed in the Black Creek Aquifer for potable water until approximately 2000. At that time, the City and County provided surface water production plants located on the Waccamaw River for service to the area. All of the wells located on the installation have been closed except for Well #1, located at Building 537 (Figure 2). The former public water supply well is operated by the City of Myrtle Beach; however, it is inactive but remains available with well house and pumping equipment still intact. It is primarily used to restore water levels in area lakes.

The base maintained one fire station (Building 360), located on the west side of the runway (Figure 2). From 1956 to closure, AFFF was stored at this location, which also served as a fire truck maintenance and wash station (Air Force Base Conversion Agency [AFBCA], 2002). Hangars 328, 355, 358, 359, and 373 maintained AFFF-based fire suppression systems at the time of closure.

Four FTAs historically were present at the base: FT006, FT007, FT011, and FT016. FTAs FT006, FT007, and FT011 were in use from the mid-1950s to 1969 prior to the use of AFFF in 1970 for fire training activities (AMEC, 2015). Waste petroleum and fuels mixed with up to 10 percent waste solvents were dispersed on the ground, set afire, and extinguished (USAF, November 1993) for fire training exercises. However, FT016 was utilized as a practice burning/extinguishing area to conduct fire training exercises from 1970 to 1992 during the time when AFFF was used to extinguish fires. A “P” was added to the site name to identify the PFC investigation and is referenced as such throughout this document. FT016P is located in the southeastern portion of the base (Figure 2).

PREVIOUS INVESTIGATIONS

Preliminary Assessment

A PA of the former Myrtle Beach AFB was prepared in 2015 as part of a USAF enterprise-wide response to possible releases of AFFF containing PFCs. The report provides findings from research conducted to determine whether and where AFFF containing PFCs was stored, handled, used, or released at the former Myrtle Beach AFB (AMEC, December 2015). Based on the research conducted during the PA, 10 potential AFFF areas associated with the former Myrtle Beach AFB were identified that potentially require further action.

Site Investigation of Fire Training Area

As previously discussed, Myrtle Beach AFB operated one FTA, FT016 (redesignated as FT016P), during the period of time that AFFF was used for firefighting training. FT016P is located one-half mile east of the main runway and north of South Road (Figure 2). In 2015, a site investigation was conducted for PFCs at FT016P. Soil and groundwater samples were collected as well as a sediment sample at the sluice gate area near the south boundary of the former installation and a water sample from former Myrtle Beach AFB public water supply well, Well #1. Results of the investigation determined that concentrations of PFOS and PFOA were found in groundwater exceeding the EPA HAs and that soil exceeded the PFOS project screening levels. Additionally, PFCs were detected in the sediment sample collected at the sluice gate;

however, the concentrations were not detected above the project screening levels. PFOS and PFOA were not detected above the laboratory reporting limit for the water sample collected from former public water supply well, Well #1 (AMEC, August 2016).

AFFF AREA BACKGROUND

The following subsections provide a brief background on each AFFF area to be investigated.

AFFF Area 1: Supply Open Storage Area 213

AFFF Area 1 is the Supply Open Storage Area 213 (Figure 3). This facility stored fire extinguishing foam; however, no releases were documented (USAF, November 1992). Since this area was only used for storage and no documentation suggesting other AFFF uses or releases was discovered during the PA, no further investigation for the presence of PFCs will be conducted at AFFF Area 1.

AFFF Area 2: Supply Open Storage Area 45202

AFFF Area 2 is the Supply Open Storage Area 45202 (Figure 3). This facility stored fire extinguishing foam; however, no releases were documented (USAF, 1992). Since this area was only used for storage and no documentation suggesting other AFFF uses or releases was discovered during the PA, no further investigation for the presence of PFCs will be conducted at AFFF Area 1.

AFFF Area 3: Building 328 (Fuels System Maintenance Dock)

AFFF Area 3 is Building 328, the Fuels System Maintenance Dock (Figure 3). This building is located on the southeastern portion of the flightline. The fuels system maintenance dock was used from 1970 until Base closure in 1993 for fuel system maintenance on aircraft after they had been drained of excess fuels at the Fuels Barn Removal Area. Building 328 maintained an AFFF-based fire suppression system and potentially discharged the system during maintenance and testing (USAF, July 1991). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 3.

AFFF Area 4: Building 355 (Corrosion Control Shop)

AFFF Area 4 is Building 355, the corrosion control shop, located on First Street between Hangar 1 and Hangar 2 (Figure 3). This facility was the primary aircraft paint shop for the Base. The corrosion control shop was used for painting aircraft from 1976 until Base closure in 1993. Building 355 maintained an AFFF-based fire suppression system with potential discharges for maintenance (USAF, July 1991). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 4.

AFFF Area 5: Building 358 (Hangar 2 – Maintenance)

Building 358 (AFFF Area 5) is located on First Street between Building 355 and 359, adjacent to the aircraft apron (Figure 3). This hangar was used for aircraft inspection and arming from 1955 until the base closed in 1993. This facility maintained an AFFF-based fire suppression system which was intentionally or unintentionally discharged between two and three times a year (Souza, July 2014). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 5.

AFFF Area 6: Building 359 (Hangar 3 – Maintenance)

AFFF Area 6 is Building 359, the former helicopter maintenance shop. This building is located north of Hangar 2 along the flightline (Figure 4). From 1955 to 1987, Hangar 3 was used as the maintenance shop for helicopters. It was also used as a practice area for structural repair work on the aircraft and for loading ordnance (missiles, munitions) onto the aircraft. This facility maintained an AFFF-based fire suppression system which was intentionally or unintentionally discharged between two and three times a year (Souza, July 2014). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 6.

AFFF Area 7: Building 360

AFFF Area 7 is Building 360, a fire station used from 1956 through 1991 (Figure 4). This facility stored AFFF for transfer to fire response vehicles and maintained a fire vehicle wash rack and associated oil/water separator, which may have processed wash water with AFFF prior to discharge into nearby drainage ditches (AFBCA, 2002). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 7.

AFFF Area 8: Building 373 (Material Hangar)

AFFF Area 8 is Building 373, a material hangar building used from 1986 until the Base closed in 1993 (Figure 4). This facility maintained an AFFF-based fire suppression system which may have been discharged accidentally or during system testing (USAF, 2016b). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 8.

AFFF Area 9: Drainage Ditches and Sluice Gate

AFFF Area 9 includes the drainage ditches and sluice gate that drain the runways, aprons, and hangars (Figure 5). Surface water features constructed throughout the base transported wastewater from buildings (via oil/water separators) and the main flightline into the Intracoastal Waterway to the north and the Atlantic Ocean to the south. A sluice gate was installed near Building 328 to contain AFFF discharged during routine maintenance of fire suppression systems at Buildings 358 and 359 (Figure 5) (Souza, July 2014). There are documented releases of AFFF potentially containing PFCs from Buildings 358 and 359 (AMEC, December 2015). In addition, there are documented releases of AFFF potentially containing PFCs along the flightline. Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 9.

AFFF Area 10: Flightline

AFFF Area 10 is the former Myrtle Beach AFB flightline (Figure 6). The flightline was reportedly used for fire training exercises that potentially involved the use of AFFF (AFBCA, 2002). Fire trucks reportedly used areas of the flightline as AFFF calibration areas and training areas. A photograph of this use at the former Myrtle Beach AFB was documented in the PA (AMEC, December 2015). Therefore, there is a potential that AFFF containing PFCs was released into the environment at AFFF Area 10.

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QAPP Worksheet #1 & 2: Title and Approval Page

Site Name/Project Name: Site Inspection of PFC Release Areas at Former Myrtle Beach Air Force Base

Site Location: Former Myrtle Beach Air Force Base, Myrtle Beach, South Carolina

Contract Number: FA8903-08-D-8785, Task Order No. 0017

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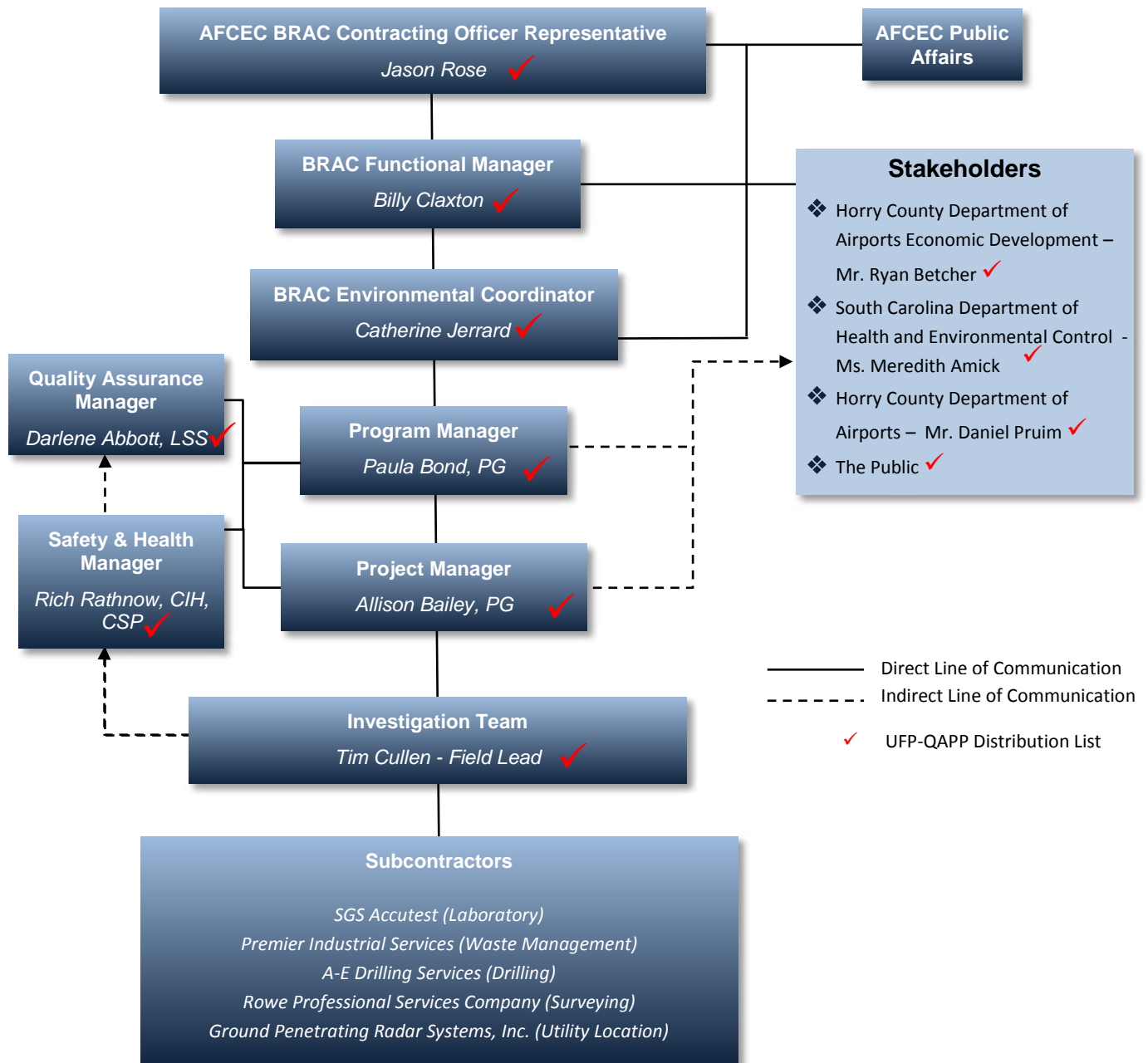
Digitally signed by C. Allison Bailey
DN: cn=C. Allison Bailey, o, ou, email=Abailey@aerostar.net,
c=US
Date: 2017.03.16 11:27:43 -0500

Signature

Relevant Plans and Reports from Previous Investigations:







- AMEC Foster Wheeler Environment and Infrastructure, Inc. (AMEC), December 2015. *Final PFC Preliminary Assessment, Former Myrtle Beach Air Force Base, Myrtle Beach, South Carolina.*
- AMEC, August 2016. *Final PFC Release Determination at Multiple BRAC Bases Site Investigation Report, FT016P, Former Myrtle Beach Air Force Base.*
- <http://www.afcec.af.mil/library/factsheets/factsheet.asp>
- <http://afcec.publicadmin-record.us.af.mil/Search.aspx#>

QAPP Worksheet #3 & 5: Project Organization and QAPP Distribution



QAPP Worksheet #4, 7 & 8: Personnel Qualifications and Sign-off Sheet

Organization: Aerostar SES LLC (ASL)

Name*	Project Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date*
Paula Bond	ASL Program Manager	BS Geology/ 22 years of experience	PG (FL, NC, and TN)	
Darlene Abbott	ASL Quality Assurance	MS Soil Science/ 15 years of experience	LSS (TN)	
Rich Rathnow	ASL Health & Safety Manager	BA Biology/ 31 years of experience	CIH, CSP	
Jenny Vance	ASL Project Chemist	BA Biology/ 25 years of experience	12-module Supervisor/Manager Training Program/Environmental Laws and Regulations	
Allison Bailey	ASL Project Manager	BS Geology/ 28 years of experience	PG (TN, GA, and FL)	
Tim Cullen	ASL Field Lead/Geologist	BS Geology/ 10 years of experience	HAZWOPER 40-hour	

Note: Signatures indicate personnel have read and agree to implement this QAPP and any future updates or addendum, as written.

ASL = Aerostar SES LLC

BS = Bachelor of Science

CSP = Certified Safety Professional

GA = Georgia

LSS = Licensed Soil Scientist

NC = North Carolina

TN = Tennessee

BA = Bachelor of Art

CIH = Certified Industrial Hygienist

FL = Florida

HAZWOPER = Hazardous Waste Operations and Emergency Response

MS = Masters of Science

PG = Professional Geologist

QAPP Worksheet #6: Communication Pathways

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #9: Project Planning Session Summary

SITE SCOPING VISIT

Date of site scoping visit: 20 October 2015

Location: Former Myrtle Beach AFB, South Carolina

Purpose: Review of area logistics, existing base conditions, and obtain AFCEC input into sampling strategy

Attendees:

- Cathy Jerrard, Base Environmental Coordinator (BEC)
- Sean Eldredge, Cherokee Nation Technology Solutions (CNTS)
- Richard Souza, FPM Group, Ltd.
- Paula Bond, ASL Program Manager
- Allison Bailey, ASL Project Manager

Summary: A site walk was conducted with project team members to confirm site conditions and understand logistics for the field activities. Each AFFF area was visited and observed for drilling access, surface water drainage patterns, and down-gradient conditions.

SAMPLING STRATEGY PLANNING MEETING

Date of Sampling Strategy Meeting: 20 January 2016

Location: San Antonio, Texas

Purpose: Review of (1) Base-specific information with the BEC, (2) area logistics, (3) existing base conditions, and (4) proposed area sampling strategies.

Attendees:

- Dave Scruggs, AFCEC BRAC Contracting Officer Representative (COR)
- Billy Claxton, AFCEC BRAC Technical Lead
- Cathy Jerrard (via telephone), BEC
- Richard Souza (via telephone), FPM
- Paula Bond, ASL Program Manager
- Allison Bailey, ASL Project Manager
- Andrea Heinzenberger, ASL Project Scientist
- Amie Whitlock, ASL Junior Geologist
- Catherine McMillen, ASL Project Manager

Scoping Visit and Sampling Strategy Meeting Summary: ASL used the findings from the scoping visit and the PFC sampling decision logic (presented in the QPP) to develop an investigation plan for the AFFF areas at the former Myrtle Beach AFB. The sampling approach and details were discussed with AFCEC during the sampling strategy meeting and are summarized below.

- Myrtle Beach has 10 AFFF Areas.
- Based on the PFC sampling decision logic, AFFF Areas 1 and 2 will not be investigated as they were used for storage only. Therefore only eight AFFF areas will be investigated as part of the SI.
- Each AFFF area and the proposed sample locations and sample quantity were discussed.
- Ms. Bond explained that ASL would collect sediment and surface water samples directly from the drain if sediment and surface water exists in them.
- Mr. Souza indicated that the material hangar (Building 373) is a relatively new building which has been repurposed to be used as a hangar. Previously, this building was located in a separate area on base. Mr. Scruggs suggested that AFFF sampling may not be warranted in this area since the building was constructed pre-1970s. Mr. Souza replied that the AFFF suppression system in the hangar was installed when the building was relocated and repurposed.
- Mr. Souza suggested adding a sediment/surface water sample in the drainage area associated with AFFF Area 8.
- During the SI completed by AMEC for FTA FT016P, a sediment and surface water sample was collected at the sluice gate. ASL has requested the results from AMEC.
- Mr. Souza suggested collecting a sediment and surface water sample near monitoring well MB-19 where the culvert from north daylight to help define the source of PFCs in this area.
- Mr. Souza indicated that the airport is a commercial airport and midday is likely the least busy time.
- Ms. Bailey indicated that the field work should take less than one week in the runway area since groundwater is relatively shallow.
- South Carolina Department of Health and Environmental Control (SCDHEC) commented on the PA that four water supply wells (600–800 ft bgs) previously existed on the installation. The wells were transferred to the city who indicated that three of the four wells have been abandoned. Proof of abandonment was provided to the Air Force and to SCDHEC.
- Ms. Jerrard will send ASL the information obtained to date on the deep wells.
- Additional boundary well samples may not be needed; however, a well survey will be completed for this installation and will determine if boundary wells are warranted. We can do well survey first and then look at boundary wells.
- Mr. Souza suggested adding an additional monitoring well along the downgradient side of runway.
- ASL will coordinate all field activities with the Myrtle Beach Airport and individual property owners.

QAPP Worksheet #10: Conceptual Site Model

The conceptual site model (CSM) is a living, dynamic model that serves to conceptualize the relationship between contaminant sources and receptors through consideration of potential or actual migration and exposure pathways. By highlighting human and ecological receptors and contaminant release mechanisms, the CSM facilitates identification of environmental indicator concerns. The CSM should organize and communicate AFFF area information relevant to base operations and past investigations and include a review of

- site characteristics related to geology, hydrogeology, and meteorology;
- actual or potential human or ecological receptors and the potential for acute and/or chronic effects based on potential media affected and exposure pathways;
- current and future land uses; and
- contaminant source characteristics, including process history of past releases and spills, areas affected, and contaminants present.

A CSM has been developed for the installation and each AFFF area based on existing data. The CSMs are provided in one combined table (Table 1) and are organized to summarize necessary area-specific information, the contaminants of potential concern (COPCs), the physical characteristics, and potential migration pathways of PFCs in the environment.

A CSM was not developed for AFFF Areas 1 and 2. AFFF Areas 1 and 2 stored AFFF but did not have AFFF dispersion systems or reported releases. Since no potential releases of AFFF containing PFCs were identified at AFFF Areas 1 and 2, they will not be investigated.

Figures 2 through 6 are companions to the following CSMs and serve to illustrate site features, relative position of sources, boundary constraints, surface water features, and groundwater flow direction. The CSMs will be updated as new data are collected and evaluated, and the revised CSMs will be included in the SI report.

Table 1 Conceptual Site Model Summary

Area/Site	Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Former Myrtle Beach Air Force Base	<p><u>Installation History:</u></p> <ul style="list-style-type: none">Myrtle Beach Air Force Base was closed under the BRAC in 1993.Myrtle Beach Air Force Base is ~ 3,800 acres.Located within the city limits of Myrtle Beach, South Carolina, between the Intracoastal Waterway and the Atlantic OceanBase was established in 1940 to train troops during WWII and was deactivated in 1947Base was reactivated in 1954 and was later designated the 354 Tactical Fighter Wing	<p><u>Topography:</u></p> <p>The installation is relatively flat.</p> <p><u>Vegetation:</u></p> <p>Vegetation in the undeveloped portions of the former Myrtle Beach AFB consists of annual grassland, seasonal wetlands, and wooded areas.</p> <p><u>Surface Water:</u></p> <ul style="list-style-type: none">Historically the site drained to a system of canals that conveyed surface runoff to the Atlantic Ocean approximately 1 mile downstreamThere is currently a detention pond downstream of FT016P that receives runoff from the rental car facilities. This detention pond was installed after fire training activities ceased.Several drainage ditches divide the base into two main basins, north and south, which discharge into water bodies outside of the base through man-made ditches. The north basin discharges to the Intracoastal Waterway and the south basin discharges into small natural streams that flow directly into the Atlantic Ocean. <p><u>Soils:</u></p> <ul style="list-style-type: none">Soils at the former installation consists predominantly of sand with a few discontinuous silt and clay layers. <p><u>Geology:</u></p> <ul style="list-style-type: none">Coastal Plain geologic units of the Horry-Georgetown County area strike in a generally northeast-southwest direction and dip gently southeastGeologic units present at Myrtle Beach include the rock formations of the Cretaceous, Quaternary, and Tertiary Systems. The formations of these systems become considerably thinner and are exposed in the Upper Coastal Plain, west of Myrtle Beach.The surface geology of the installation area has been summarized by Glowacz as distinct lithologic units of the Quaternary Age Socastee Formation. <p><u>Hydrogeology:</u></p> <ul style="list-style-type: none">The former Myrtle Beach Air Force Base is underlain by four main aquifer systems, each aquifer named after the stratigraphic unit in which it lies. In ascending order they are the Middendorf, the Black Creek, the Peedee, and the combined Shallow Water Table and Artesian Aquifer systems.The Middendorf aquifer system contains salty water throughout the area and, as a consequence, has not been developed as a groundwater supply source.Historically, the Black Creek aquifer system was the most common source of potable water in the area and was used for industrial, municipal, and domestic purposes. The Black Creek is a confined aquifer, hydraulically separated by clay from the Middendorf Aquifer below it. Yields as high as 1,000 gallons per minute have been obtained from wells in the vicinity.The Peedee aquifer system is typically artesian in nature and is sometimes used in conjunction with the Black Creek aquifer as a source of water. Clay layers separating the Peedee stratigraphic unit from Black Creek act as aquitards between the units. Water from the Peedee aquifer is treated for removal of iron and sulfate prior to municipal use.As of 2000, drinking water is supplied to the Former Myrtle Beach AFB and residents of the surrounding area by the Grand Strand Water and Sewer Authority Myrtle Beach Surface Water Treatment Facility that withdraws and treats water from Pee Dee and Waccamaw River.Groundwater within the Shallow Water Table and Artesian Aquifer System typically occurs within a few feet bgs and extend to depths ranging from 30 to 40 ft below ground surface. The shallow groundwater flow direction varies seasonally and by site. The shallow groundwater generally flows southeast in the southern portion of the Base, and to the west in the northern portion. Groundwater likely discharges to canals and unnamed streams. <p><u>Meteorology:</u></p> <ul style="list-style-type: none">The climate at the former Myrtle Beach AFB is characterized as humid subtropical.Average annual rainfall is 48.24 inches and occurs mostly in the summer months	<p><u>Contaminants of Potential Concern (COPCs):</u></p> <p>PFOS, PFHxS, PFOA, PFDA, PFDoA, PFTTrDA, PFHpA, PFNA, PFBS, PFTA, PFHxA, PFUnA, N-EtFOSAA, and N-MeFOSAA are the COPCs for this investigation.</p> <p><u>Media of Potential Concern:</u></p> <p>Groundwater, soil, surface water and sediment</p> <p><u>Potential AFFF Releases:</u></p> <ul style="list-style-type: none">PFCs have been identified in sediment, soil and groundwaterReleases of AFFF containing PFCs could have occurred on the installation through fire-fighting activities, fire-fighting training activities, washing of fire trucks and equipment, calibration and operation of AFFF fire suppression systems, and the storage, handling and disposal of AFFF.AFFF was historically noted in drainage canals and on the beach due to AFFF fire suppression systems in Hangars 358 and 359. As a result of these releases, a sluice gate was installed in the canal leading to the beach to control the release of foam. <p><u>Potential Pathways:</u></p> <ul style="list-style-type: none">AFFF containing PFCs released onto the ground would most likely leach through the soil into groundwater and could migrate off the Former Myrtle Beach AFB to potential down gradient drinking water receptors.AFFF could be transported in surface water runoff or drainage discharge into area ditches and creeks, and move to downstream areas frequented by recreational users.Previous sampling of the soil and groundwater in the Fire Training Area (FT016P) indicated the presence of PFCs in groundwater at concentrations exceeding the HAs. <p><u>Potential Distribution:</u></p> <ul style="list-style-type: none">In soil at or adjacent to AFFF release areas.In groundwater near source areas from infiltration through the soil profile.In groundwater downgradient of source areas via migration.In surface water and/or sediment within the canals	<p><u>Current Landowners:</u></p> <p>The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u></p> <ul style="list-style-type: none">The former airfield area is currently the Myrtle Beach International Airport.A portion of the former base has been transferred to the City for recreational use, to the Horry-Georgetown Technical Community College, to the Market Common shopping and housing complex, and to other housing developers. <p><u>Future Land Use:</u></p> <ul style="list-style-type: none">The area south of the airfield along Highway 17 Business may be commercially developed in the future.Expanded housing development and commercial support activities are under construction on the west side of the former Air Force Base.Commercial and industrial aerospace related activities are proposed directly adjacent to the west side of the airfield. <p><u>Potential Receptors:</u></p> <ul style="list-style-type: none">Potential receptors associated with current and future land use include onsite workers, downgradient residents, downstream recreational surface water users and biota.	<p><u>Potential Ecological Receptors:</u></p> <p>Inland and marine plant species, fish, birds, insects, soil invertebrates, and mammals that inhabit or migrate through the site.</p> <p><u>Threatened and Endangered Species and Species of Concern:</u></p> <p>Birds</p> <ul style="list-style-type: none">Bald EagleKirtland’s WarblerRed-cockaded woodpeckerWood StorkPiping PloverRed Knot <p>Flowering Plants</p> <ul style="list-style-type: none">PondberryCanby’s DropwortAmerican ChaffseedSeabeach Amaranth <p>Mammals</p> <ul style="list-style-type: none">West Indian Manatee <p>Reptiles</p> <ul style="list-style-type: none">Hawksbill Sea TurtleLeatherback Sea TurtleKemp’s Ridley Sea TurtleGreen Sea TurtleLoggerhead Sea Turtle

Area/Site	Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
Site Specific Characteristics					
AFFF Area 3	<ul style="list-style-type: none">AFFF Area 3 is Building 328This area was utilized by the Air Force as a fuels system maintenance dock from 1970 through 1993The facility maintained an AFFF-based fire suppression system with potential discharges for system maintenanceBuilding 328 is within the Land Use Control area of B324 (Solid Waste Management Unit [SWMU] 40), where the groundwater is contaminated with chlorinated solvents (CB&I, 2016a)	<p><u>Topography:</u> Building 328 is situated on a level parcel of land.</p> <p><u>Vegetation:</u> AFFF Area 3 is primarily surrounded by concrete, however, grass areas are present on the east and west sides of the building.</p> <p><u>Surface Water:</u> There are no surface water features within AFFF Area 3.</p> <p><u>Soil/Geology/Hydrogeology:</u> Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and flows southeast.</p>	<p><u>COPCs:</u></p> <ul style="list-style-type: none">Same as general installation.Other contaminants that have been previously identified (and remediated) near this area include chlorinated solvents. <p><u>Media of Potential Concern:</u> Groundwater and soil</p> <p><u>Potential AFFF Releases:</u></p> <ul style="list-style-type: none">AFFF may have been released into the environment from testing or use of the fire suppression system.PFCs may have been released from AFFF into nearby soil.PFCs may have leached from the soil into groundwater.	<p><u>Current Landowners:</u> The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u> Currently AFFF Area 3 is utilized as an airport hangar.</p> <p><u>Future Land Use:</u> Land use is not expected to change in the future.</p> <p><u>Potential Receptors:</u> Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.
AFFF Area 4	<ul style="list-style-type: none">AFFF Area 4 is Building 355, the Corrosion Control ShopBuilding 355 was utilized by the Air Force from 1976 through 1993Facility maintained an AFFF-based fire suppression system with potential discharge(s) for system maintenance	<p><u>Topography:</u> Building 355 is situated on a level parcel of land.</p> <p><u>Vegetation:</u> AFFF Area 4 is primarily surrounded by concrete, however, grass areas are present on the east and west sides of the hangar.</p> <p><u>Surface Water:</u> There are no surface water features within AFFF Area 4.</p> <p><u>Soil/Geology/Hydrogeology:</u> Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and flows to the south east</p>	<p><u>COPCs:</u> Same as general installation.</p> <p><u>Media of Potential Concern:</u> Groundwater and soil</p> <p><u>Potential AFFF Releases:</u></p> <ul style="list-style-type: none">AFFF may have been released into the environment from testing or use of the fire suppression system.PFCs may have been released from AFFF into nearby soil.PFCs may have leached from the soil into groundwater.	<p><u>Current Landowners:</u> The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u> Currently AFFF Area 4 is utilized as a corrosion control shop.</p> <p><u>Future Land Use:</u> According to airport personnel, the use of this building is not expected to change in the future.</p> <p><u>Potential Receptors:</u> Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.
AFFF Area 5	<ul style="list-style-type: none">AFFF Area 5 is Building 358, a maintenance hangarBuilding 358 was utilized by the Air Force from 1957 through 1993Facility maintained an AFFF-based fire suppression system which was intentionally or unintentionally discharged between two and three times a year	<p><u>Topography:</u> Building 358 is situated on a level parcel of land.</p> <p><u>Vegetation:</u> AFFF Area 5 is primarily surrounded by concrete, however, grass areas are present on the east and west sides of the hangar.</p> <p><u>Surface Water:</u> There are no surface water features within AFFF Area 5.</p> <p><u>Soil/Geology/Hydrogeology:</u></p> <ul style="list-style-type: none">Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and flows southeast.	<p><u>COPCs:</u> Same as general installation.</p> <p><u>Media of Potential Concern:</u> Groundwater and soil</p> <p><u>Potential and Confirmed AFFF Releases:</u></p> <ul style="list-style-type: none">AFFF was released into the environment from testing or use of the fire suppression system two to three times a yearPFCs may have been released from AFFF into the drainage ditches.PFCs may have been released from AFFF into nearby soil.PFCs may have leached from the soil into groundwater.	<p><u>Current Landowners:</u> The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u> Currently AFFF Area 5 is utilized as an airport hangar.</p> <p><u>Future Land Use:</u> According to airport personnel, the use of this building is not expected to change in the future.</p> <p><u>Potential Receptors:</u> Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.

Area/Site	Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
AFFF Area 6	<ul style="list-style-type: none">AFFF Area 6 is Building 359, a maintenance hangarBuilding 359 was utilized by the Air Force from 1957 through 1993Facility maintained an AFFF-based fire suppression system which was intentionally or unintentionally discharged between two and three times a year	<p><u>Topography:</u> Building 359 is situated on a level parcel of land.</p> <p><u>Vegetation:</u> AFFF Area 3 is primarily surrounded by concrete, however, grass areas are present on the east and west sides of the building.</p> <p><u>Surface Water:</u> There are no surface water features within AFFF Area 6. .</p> <p><u>Soil/Geology/Hydrogeology:</u> Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and flows southeast.</p>	<p><u>COPCs:</u> Same as general installation.</p> <p><u>Media of Potential Concern:</u> Groundwater and soil</p> <p><u>Potential and Confirmed AFFF Releases:</u></p> <ul style="list-style-type: none">AFFF was released into the environment from testing or use of the fire suppression system two to three times a yearPFCs may have been released from AFFF into the drainage ditches.PFCs may have been released from AFFF into nearby soil.PFCs may have leached from the soil into groundwater.	<p><u>Current Landowners:</u> The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u> Currently AFFF Area 6 is utilized by the DoD. Prescott Aviation will be required to coordinate access.</p> <p><u>Future Land Use:</u> Land use is not expected to change in the future.</p> <p><u>Potential Receptors:</u> Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.
AFFF Area 7	<ul style="list-style-type: none">AFFF Area 7 is Building 360, a fire station and wash rack and oil/water separator 19Building 360 was utilized by the Air Force from 1956 through 1991Facility stored AFFF for transfer to fire vehicles, and maintained a fire vehicle wash rack and associated oil/water separator which may have processed wash water with AFFF prior to discharge into a nearby drainage ditch	<p><u>Topography:</u> Building 360 is situated on a level parcel of land.</p> <p><u>Vegetation:</u> AFFF Area 7 is primarily surrounded by concrete, however, grass areas are present on the north, south, and west sides of the building.</p> <p><u>Surface Water:</u> There is a surface water drainage area located behind the fire station that receives runoff from the apron and portions of the fire station where AFFF containing PFCs may have been released.</p> <p><u>Soil/Geology/Hydrogeology:</u> Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and flows southeast</p>	<p><u>COPCs:</u> Same as general installation.</p> <p><u>Media of Potential Concern:</u> Groundwater, soil, surface water and sediment</p> <p><u>Potential and Confirmed AFFF Releases:</u></p> <ul style="list-style-type: none">AFFF may have been released into the environment from testing or use of the fire suppression system two to three times a yearPFCs may have been released from AFFF into the drainage ditches.PFCs may have been released from AFFF into nearby soil.PFCs may have leached from the soil into groundwater.	<p><u>Current Landowners:</u> The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u> Currently AFFF Area 7 is utilized as an Airport Grounds Maintenance Department.</p> <p><u>Future Land Use:</u> Land use is not expected to change in the future.</p> <p><u>Potential Receptors:</u> Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.
AFFF Area 8	<ul style="list-style-type: none">AFFF Area 8 is Building 373, a material and technical training hangarBuilding 373 was utilized by the Air Force from 1986 through 1993The facility maintained an AFFF-based fire suppression system with potential discharges for system maintenanceAFFF Area 8 lies up-gradient and east of the Building 505 (SWMU 79/80) LUC Boundary.	<p><u>Topography:</u> Building 373 is situated on a level parcel of land.</p> <p><u>Vegetation:</u> AFFF Area 8 is primarily surrounded by grass with a concrete driveway on the north side of the building.</p> <p><u>Surface Water:</u> There are no surface water features within AFFF Area 8.</p> <p><u>Soil/Geology/Hydrogeology:</u> Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and flows west.</p>	<p><u>COPCs:</u> Same as general installation.</p> <p><u>Media of Potential Concern:</u> Groundwater and soil</p> <p><u>Potential AFFF Releases:</u></p> <ul style="list-style-type: none">AFFF may have been released into the environment from testing or use of the fire suppression system.PFCs may have been released from AFFF into nearby soil.PFCs may have leached from the soil into groundwater.	<p><u>Current Landowners:</u> The airport is owned by Horry County, South Carolina.</p> <p><u>Current Land Use:</u> Currently AFFF Area 8 is utilized by Executive Helicopter as a helicopter and maintenance hangar.</p> <p><u>Future Land Use:</u> Land use is not expected to change in the future.</p> <p><u>Potential Receptors:</u> Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.

Area/Site	Facility Profile	Physical Profile	Release Profile	Land Use and Exposure Profile	Ecological Profile
AFFF Area 9	<ul style="list-style-type: none">AFFF Area 9 is the Drainage Ditches and Sluice GateSurface water features constructed throughout the former installation transported stormwater runoff and also wastewater from buildings (via oil/water separators) and the main flightline into the Intracoastal Waterway and Atlantic Ocean.A sluice gate was installed near Building 328 to contain AFFF discharged during routine maintenance of fire suppression systems at buildings 358 and 359.The sluice gate is within the Land Use Control area of B324 (SWMU 40), where the groundwater is contaminated with chlorinated solvents (CB&I, January 2016)	<p>Topography: AFFF Area 9 is comprised of several drainage ditches, which are inherently lower than the surrounding land. The installation mounds near the center and drains to the northwest and southeast.</p> <p>Vegetation: The ditches are unlined channels with wetland vegetation on the sidewalls and bottom</p> <p>Surface Water: Several drainage ditches divide the base into two main basins, north and south, which discharge into water bodies outside of the base through man-made ditches. The north basin discharges to the Intracoastal Waterway and the south basin discharges into small natural streams that flow directly into the Atlantic Ocean.</p> <p>Soils/Geology/Hydrogeology: Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and general flows to the southeast in the southern portion of the installation, and to the west in the northern portion.</p>	<p>COPCs:</p> <ul style="list-style-type: none">Same as general installation.Other contaminants that have been previously identified (and remediated) at this area include chlorinated solvents. <p>Media of Potential Concern: Surface water and sediment</p> <p>Potential and Confirmed AFFF Releases:</p> <ul style="list-style-type: none">AFFF releases were confirmed from buildings 358 and 359, which discharged significant amounts of AFFF into the drainage channel near Building 328 that reached the Atlantic Ocean on more than one occasion. The releases of AFFF into the ocean led to the installation of the sluice gate to prevent further off-base discharges.AFFF may have been released into the environment from surface water leaving the base.	<p>Current Landowners: The airport is owned by Horry County, South Carolina.</p> <p>Current Land Use: Currently AFFF Area 9 (the drainage ditches and sluice gate) is utilized to discharge stormwater runoff from the airport.</p> <p>Future Land Use: Land use is not expected to change in the future.</p> <p>Potential Receptors: Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.
AFFF Area 10	<ul style="list-style-type: none">AFFF Area 10 is the flightline that was used for fire training exercises that potentially involved AFFFFoam dispersed on the runway would most likely runoff into site soils or drainage ways along the concrete runway.	<p>Topography: AFFF Area 10 is generally level.</p> <p>Vegetation: AFFF Area 10 is a concrete runway and is surrounded by low grass vegetation.</p> <p>Surface Water: Drainage ditches and drains located along the flightline discharge to the north and south</p> <p>Soil/Geology/Hydrogeology: Same as general installation. Groundwater is ~7-12 feet bgs at this AFFF Area and generally flows west.</p>	<p>COPCs:</p> <ul style="list-style-type: none">Same as general installation.Other contaminants that have been previously identified (and remediated) at this area (the FOLTA) include 2-Methylnaphthalene, 1,2,4-TMB, 1,3,5-TMB, benzene, and naphthalene. <p>Media of Potential Concern: Soil, groundwater, sediment and surface water</p> <p>Potential and Confirmed AFFF Releases:</p> <ul style="list-style-type: none">AFFF was potentially dispersed on the runway in preparation for emergency aircraft landings and/or training exercisesPFCs released onto the ground may have leached through the soil into groundwater.PFCs may also be adsorbed to soil particles and remain close to the source.AFFF may have runoff into stormwater drainage ditches	<p>Current Landowners: The airport is owned by Horry County, South Carolina.</p> <p>Current Land Use: Currently AFFF Area 10 is an active runway.</p> <p>Future Land Use: Land use is not expected to change in the future.</p> <p>Potential Receptors: Potential receptors associated with current and future land use include onsite workers and biota.</p>	Same as profile for installation.

~ = approximately
AFB = Air Force Base
AFFF = aqueous film forming foam
bgs = below ground surface
BRAC = base realignment and closure
COPCs = contaminants of potential concern
DoD = Department of Defense

N-EtFOSAA = N-ethyl perfluorooctanesulfonamidoacetic acid
N-MeFOSAA = N-methyl Perfluorooctanesulfonamidoacetic acid
PFBS = Perfluorobutanesulfonic acid
PFCs = perfluorinated compounds
PFDA = Perfluorodecanoic acid
PFDoA = Perfluorododecanoic acid

PFHpA = Perfluoroheptanoic acid
PFHxA = Perfluorohexanoic acid
PFHxS = Perfluorohexanesulfonic acid
PFNA = Perfluorononanoic acid
PFOA = Perfluorooctanoic acid
PFOS = Perfluorooctanesulfonic acid

PFTA = Perfluorotetradecanoic acid
PFTrDA = Perfluorotridecanoic acid
PFUnA = Perfluoroundecanoic acid
SWMU = Solid Waste Management Unit
WWII = World War II

QAPP Worksheet #11: Project/Data Quality Objectives

Step 1: State the Problem	Step 2: Identify the Goal of the Study	Step 3: Identify the Information Inputs	Step 4: Define the Boundaries of the Study	Step 5: Develop the Analytic Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop the Plan for Obtaining Data
SI Stage DQO – Investigate Possible Releases and Determine Need for Further Sampling						
<p>PFCs are a large group of synthetic fluorinated compounds that are widely used to make everyday products more resistant to heat, stains, grease, and water; they are also used as components in firefighting foams. The DoD has determined PFCs (including PFOA/PFOS) are ECs. The DoD, including the USAF, used AFFF containing PFCs (PFOS and/or PFOA) for firefighting and firefighting training activities (USAF, August 2012).</p> <p>The problem: PFCs may have been released into the environment through the use of AFFF at former USAF installations; therefore, a risk to human health and the environment may exist.</p> <p>Under Air Force Instruction 32-7020 (USAF, November 2014), and the USAF Policy on ECs (USAF, August 2016a), the Air Force (including the BRAC Restoration program) is required to investigate and mitigate human exposure from ECs if needed. Therefore, investigation activities are necessary to determine the presence or absence of these compounds at AFFF areas at BRAC facilities.</p>	<p>1. Determine if PFCs are present in groundwater, soil, surface water, sediment, and/or other environmental media as necessary.</p> <p>2. Determine if concentrations of PFOS, PFOA or the sum of both exceed 0.07 µg/L in groundwater.</p> <p>3. Identify potential human health receptors and pathways.</p> <p>4. Where PFOA and/or PFOS are found in groundwater, determine if drinking water wells are impacted.</p>	<p><u>Existing information inputs:</u></p> <ul style="list-style-type: none">Existing historical records on site use, releasesPA ReportSite scoping visitPost scoping conference callsEPA Health Advisories2012 Interim Air Force Guidance on Sampling and Response Actions for Perfluorinated Compounds at Active and BRAC Installations2016 SAF/IE Policy on Perfluorinated Compounds (PFCs) of Concern <p><u>New information inputs:</u></p> <ul style="list-style-type: none">Collection of soil, sediment, surface water, groundwater, and/or other environmental media samples as necessary<ul style="list-style-type: none">Soil boring advancementMonitoring well installation, development, and/or rehabilitation <p>Laboratory analysis of PFCs by LC-MS/MS in the above mentioned environmental media.</p>	<p>Temporal Boundaries: AFFF containing PFCs was first used by the Air Force in the early 1970s. Sample locations will take into account any significant changes to the AFFF areas (for example, soil removal, grading, construction, etc.) since this time.</p> <p>Spatial Boundaries: Sampling will occur at AFFF area as shown on Figures 2-6. Soil samples will be collected from 0-2 feet bgs and the 2 foot interval above the water table (anticipated to be from 8 to 10 feet bgs) Groundwater samples will be collected in existing wells at screened intervals between a minimum of 5 feet bgs and a maximum of 40 feet bgs. Surface water samples will be collected from the top six inches of water within the drainage ditches. Sediment samples will be collected from the top 3 inches of sediment within the drainage ditches, co-located with the surface water samples.</p>	<p>Soil, groundwater, and/or other environmental media samples will be analyzed for PFCs by LC-MS/MS. Worksheet 15 in the General QPP identifies the project action limits for determining the presence of PFOS and PFOA in soil, sediment, surface water, groundwater, and other environmental media as necessary. In addition, the following 12 PFCs will be analyzed by LC-MS/MS:</p> <div><div>- PFBS,</div><div>- PFDoA,</div><div>- PFHxA,</div><div>- PFNA,</div><div>- PFTTrDA,</div><div>- N-EtFOSAA, and</div><div>- PFDA,</div><div>- PFHpA,</div><div>- PFHxS,</div><div>- PFTA,</div><div>- PFUnA,</div><div>- N-MeFOSAA.</div></div> <p>The selected PFCs are of interest because production of AFFF was not consistent across time or manufacturers with various formulations being used at different times at the various installations.</p> <p>Of these analytes, only two (PFOS and PFOA) have HA levels established by the EPA. For PFCs without a screening value, results will be evaluated in terms of whether the chemical was detected.</p> <p>The following actions will be taken upon evaluation of the analytical data:</p> <ul style="list-style-type: none">If sampling indicates no PFCs are detected above HAs, then no further action will be recommended.If sampling indicates that PFCs are present in groundwater above the HAs, further sampling will be conducted to determine if a complete human receptor pathway via ingestion exists.If sampling indicates PFC concentrations in drinking water are above the HAs, then mitigation will be conducted.	<p>The following performance and acceptance criteria will be used during PFC investigation activities:</p> <ul style="list-style-type: none">The ASL field manager will complete the daily standardized PFC PPE/equipment checklist (provided in the PFC protocol SOP for each installation). The quality manager will review and accept the final checklist.The field manager will verify that field procedures defined in the QPP and Installation-Specific UFP-QAPP Addenda are properly followed daily during fieldwork. The quality manager or designee will verify field procedures are being conducted appropriately through field audits. Any deviations will be promptly addressed and documented on the field audit form.The analytical laboratory is accredited under the DoD ELAP for PFC analysis. The laboratory has analyzed one set of proficiency evaluation (PE) samples consisting of both soil and water matrices to demonstrate capability prior to initiating the sampling program. The acceptance limits were set at 60 percent to 140 percent recovery for both matrices. Recoveries outside those limits are not necessarily considered failures, but serve as indicators that data for the affected analytes should undergo extra attention during validation. No data will be qualified based on PE recoveries without other quality control parameter failures. Vista successfully analyzed the PE samples and all recoveries for the analytes of interest were within the 60 to 140% acceptance limits.The project chemist or designee will conduct an audit prior to sampling to evaluate laboratory procedures, quality program, and operations to verify analytical procedures meet EPA and DoD criteria. Any findings or recommendations will be documented in Laboratory Technical Systems/Performance Audits Report and Worksheets #31, 32 & 33, and addressed prior to analysis of field samples.The laboratories will adhere to analytical performance/ acceptance criteria per method as detailed in the DoD QSM V5.0 and defined on Worksheet #12.The LC-MS/MS method will provide acceptable detection limits (as low as reasonably achievable) to confirm presence of PFCs at concentrations defined in Worksheet 15.EPA Stage 2B data verification will be conducted on 100 percent of the data and EPA Stage IV data validation will be conducted on 10 percent of the analytical data by an experienced chemist to assess the data usability. The data usability will then be evaluated by AFCEC for final approval. Data completeness (or the percentage of laboratory measurements considered to meet the DQOs on a method-by-method basis) of 90 percent usable data as determined through the data validation process is required.	<p>The sampling approach is generally designed to collect grab samples from groundwater, surface water, soil, sediment, and/or other environmental media biased toward those locations most likely to be impacted by PFCs. ASL will obtain authorization for well installation with submittal of SCDHEC Monitoring Well Application, Form DHEC 3736. Submittal will occur prior to mobilization to the site, and under separate cover to SCDHEC. Details of the sampling approach are included in Worksheets #17, #18, and #20, and illustrated on Figures 2-6.</p>

µg/L = micrograms per liter
bgs = below ground surface
ECs = emerging contaminants
MS = matrix spike
PA = preliminary assessment
PFDoA = Perfluorododecanoic acid
PFOA = Perfluorooctanoic acid
PPE = personal protective equipment
SI = site inspection

AFCEC = Air Force Civil Engineer Center
BRAC = base realignment and closure
ELAP = Environmental Laboratory Accreditation Program
MSD = matrix spike duplicate
PE = proficiency evaluation
PFHpA = Perfluoroheptanoic acid
PFOS = Perfluorooctanesulfonic acid
QAPP = quality assurance project plan
SOP = standard operating procedure

AFFF = aqueous film forming foam
DoD = Department of Defense
EPA = US Environmental Protection Agency
N-EtFOSAA = N-ethyl perfluorooctanesulfonamidoacetic acid
PFBS = Perfluorobutanesulfonic acid
PFHxA = Perfluorohexanoic acid
PFTA = Perfluorotetradecanoic acid
QPP = quality program plan
UFP = uniform federal policy

AFI = Air Force Instruction
DoDI = Department of Defense Instruction
HA = health advisory
PFCs = perfluorinated compounds
PFHxS = Perfluorohexanesulfonic acid
PFTTrDA = Perfluorotridecanoic acid
QSM = quality systems manual
USAF = United States Air Force

ASL = Aerostar SES LLC
DQOs = data quality objectives
LC-MS/MS = liquid chromatography and tandem mass spectrometry
N-MeFOSAA = N-methyl Perfluorooctanesulfonamidoacetic acid
PFDA = Perfluorodecanoic acid
PFNA = Perfluorononanoic acid
PFUnA = Perfluoroundecanoic acid
RI = remedial investigation

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QAPP Worksheet #12: Measurement Performance Criteria

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #13: Secondary Data Uses and Limitations

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
Identification of AFFF areas	AMEC, December 2015. <i>Final PFC Preliminary Assessment, Former Myrtle Beach Air Force Base, Myrtle Beach, South Carolina.</i>	Describes the AFFF Areas identified at the installation and gives information on the base history and environmental setting.	None identified
Site Investigation of FTA FT016P	AMEC, August 2016. <i>Final PFC Release Determination at Multiple BRAC Bases, Site Investigation Report, Former Myrtle Beach Air Force Base.</i>	Provides the description of the FTA and the PFC investigation at FT016P including results of soil and groundwater	None identified
AFFF Area 1 and 2 History	USAF, November 1993. <i>Basewide Environmental Baseline Survey, Myrtle Beach Air Force Base, South Carolina.</i>	Provides history of buildings 213 and 45202 environmental findings.	None identified
AFFF Area 3 and 4 History	USAF, 1991. <i>354 Tactical Fighter Wing Spill Prevention and Response Plan.</i> July.	Describes containment procedures of AFFF releases and probable spill routes.	None identified
AFFF Area 3 Plume	CB&I Federal Services, LLC (CB&I), January 2016. <i>2014 Biennial Corrective Measure Progress Report, Building 324 (SWMU 40) Area, Myrtle Beach Air Force Base, South Carolina.</i>	Provides the most up-to-date information on the existing VOC plume and information on existing wells and groundwater flow direction in the area associated with Building 324 (SWMU 40).	None Identified
AFFF Area 5, 6 and 8 History	USAF, 2016b. United States Air Force Real Property Records, provided internally by USAF. Accessed September 4, 2016.	Lists Myrtle Beach AFB buildings and facilities and Real Property installed equipment, including fire suppression equipment.	None identified
AFFF Area 7 and 10 History	AFBCA, 2002. <i>Myrtle Beach Air Force Base, Finding of Suitability for Transfer and Supplemental Environmental Baseline Survey for ROD Parcels #1 & 3, ROD Parcels #5 and #6-25.</i> March and April.	Indicates storage of AFFF at B360 (6,815 kg) and also indicates status of environmental factors for B355, B358, B359, B360, B373, and the flightline.	None identified

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

Data type	Source	Data uses relative to current project	Factors affecting the reliability of data and limitations on data use
Site Investigation of FOLTA and AFFF Area 9 and 10 Vicinity	CB&I, September 2016. <i>Corrective Measure Completion Report Forward Operating Location Training Area (SWMU 255) Myrtle Beach Air Force Base, Myrtle Beach, South Carolina.</i>	Provides the most up-to-date information on existing wells in the area and groundwater flow direction in the area associated with the FOLTA (SWMU 255).	None identified

AFB = Air Force Base

AFBCA = Air Force Base Conversion Agency

AFFF = aqueous film forming foam

AMEC = AMEC Foster Wheeler Environment and Infrastructure, Inc.

CB&I = CB&I Federal Services, LLC

FOLTA = Forward Operating Location Training Area

FTA = fire training area

kg = kilograms

ROD = Record of Decision

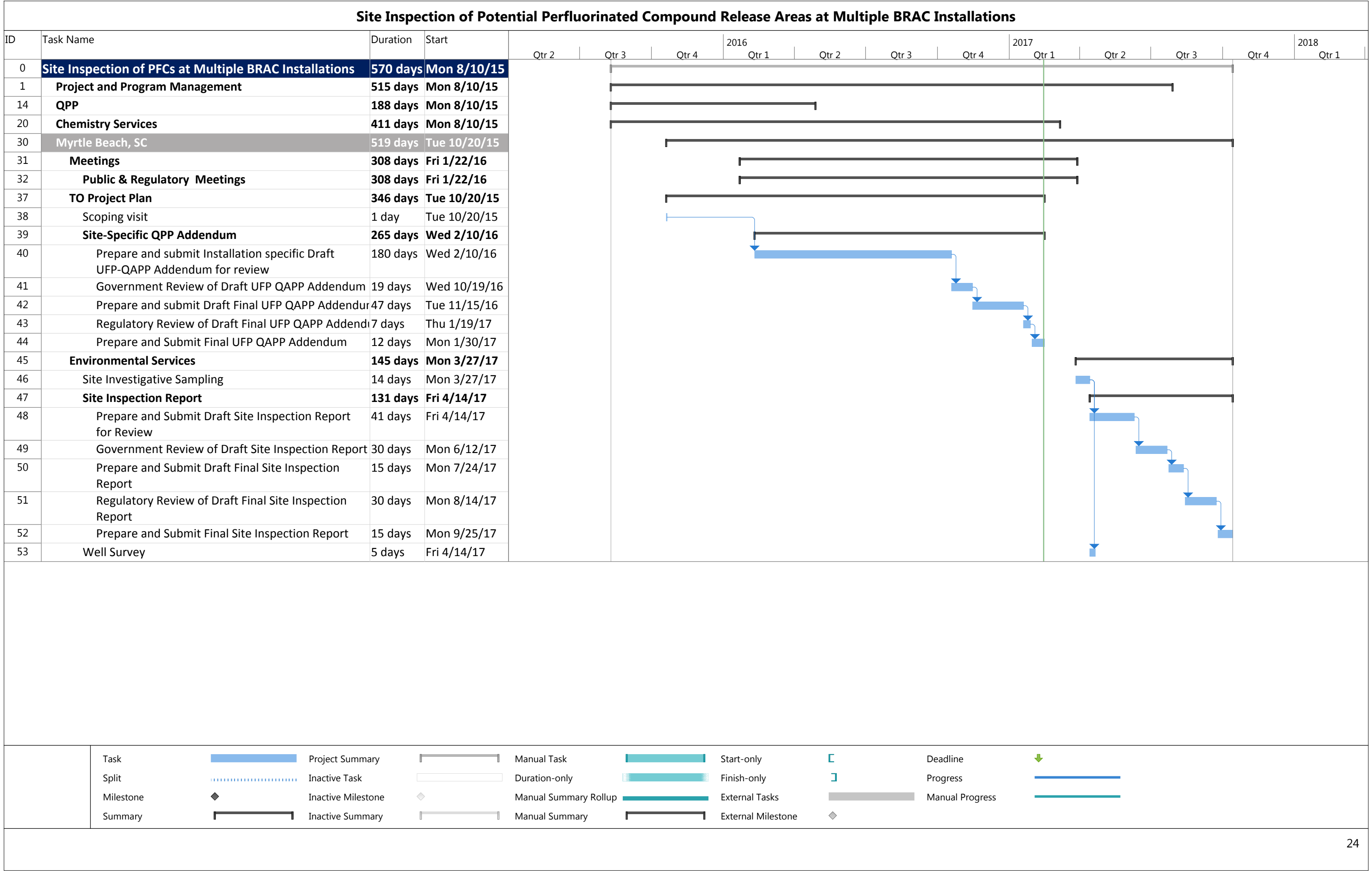
SWMU = Solid Waste Management Unit

USAF = United States Air Force

VOC = volatile organic compound

QAPP Worksheet #14/16: Project Tasks & Schedule

The project schedule is provided on the following page.



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QAPP Worksheet #15: Action Limits and Laboratory-Specific Detection/Quantitation Limits

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #17: Sampling Design and Rationale

Based on discussions between ASL and AFCEC during the site scoping visit on 20 October 2015, the sampling strategy meeting on 20 January 2016, and review of the document sources referenced throughout this UFP-QAPP addendum, ASL has developed a sampling program that is designed to confirm whether AFFF containing PFCs has been released into the environment at the former Myrtle Beach AFB.

Planning Activities

During the field work planning stage and prior to the initial mobilization, the following activities will be conducted:

- Site access will be coordinated with the MBIA and the individual property owners.
- QPP and health and safety planning – ASL field personnel will review the project standard operating procedures (SOPs), work plan and general and site-specific health and safety requirements, as well as subcontractor HSPs and training records.
- Well permits from the SCDHEC will be obtained prior to the start of field work for the proposed borings and new monitoring wells through submittal of SCDHEC Monitoring Well Application, Form 3736. Drilling cannot proceed at the site until SCDHEC has issued an approval to the soil boring/monitoring well request. An approval to the request will include SCDHEC site-specific requirements for installation and abandonment of the borings/wells identified in the request.
- A Federal Aviation Administration permit will be obtained prior to conducting the work at the runway (AFFF Area 10, Flightline).
- Utility clearances – Prior to mobilization of drilling equipment, Palmetto Utility Protection Service (South Carolina 811) and a private utility locate service (Ground Penetrating Radar Systems) will be notified to mark underground utilities. The presence of utilities near drilling locations will be verified using a hand-held magnetometer or utility probe by a private utility location contractor. Additionally, geographic information system records and other site engineering records will be examined regarding utility line locations. The first four feet at each drilling location will be advanced using a hand auger.

Environmental Sampling Rationale

To confirm releases of AFFF containing PFCs, soil, sediment, groundwater, and surface water sampling will be conducted at the preselected locations (Figures 2–6). Table 2 summarizes the sampling strategy and rationale for the PFC investigation at the former Myrtle Beach AFB. The general UFP-QAPP (ASL, May 2016) provides the SOPs and a detailed description of sampling methodologies. ALS SOP-28P_R2 addresses sampling protocol to avoid introducing PFCs or PFC-related chemicals to sample. Sampling will be conducted in accordance with the ASL SOPs and SCDHEC guidance.

The sampling design was based on a general AFFF area investigation decision logic to provide sampling consistency across the PFC program. The decision logic is intended as a guide, providing the minimum level of sampling effort for each AFFF area. The actual number and location of samples are based on AFFF Area-specific characteristics. It should be noted that the USAF has made a programmatic decision to not sample those AFFF areas identified in the PA where only storage activities took place and where no documented release of AFFF occurred. Soil boring and groundwater sample locations were selected based on site assessments and site reconnaissance and are biased toward potential source(s) areas, known spill locations, and downgradient migration pathways. The objective of the SI groundwater investigation is to determine if PFCs are present in the upper groundwater zone at the AFFF areas (potential source(s) areas).

Soil Boring Advancement/Abandonment and Soil Sample Collection

Twenty six soil borings will be advanced using either hollow stem augers or a direct push drill rig. Continuous soil cores will be collected and logged by a qualified professional in accordance with the

Unified Soil Classification System. Two soil samples will be collected from each borehole as specified in Worksheet #18. All work will be conducted in accordance with ASL SOP-013_R1, “Soil Sampling” and a handheld global positioning system will be used to locate each boring location. Soil sample collection will be recorded in the field log and on soil sample collection forms, and boring logs will be recorded on drilling logs. If possible, two soil samples will be collected from each boring at the following depths:

- Surface: 0 to 2 feet bgs and
- Just above water table: approximately 8–10 feet bgs.

Direct Push Soil Sampling

Ten direct-push soil samples will be collected from AFFF Area 10 along the runway as presented in Figure 6. If possible, two soil samples will be collected from each boring at the following depths:

- Surface: 0 to 2 feet bgs and
- Just above water table: approximately 8–10 feet bgs.

Direct Push Groundwater Sampling

Groundwater samples will be collected using direct-push methods at each direct-push soil boring location. Groundwater will be extracted and sampled through an expendable Geoprobe® screen point sampler via a peristaltic pump. If groundwater is present but recovery is limited, ASL will utilize 1-inch polyvinyl chloride (PVC) screen and riser to allow for overnight groundwater recovery and sampling. The proposed number of samples for each AFFF area are detailed in the Table 2. Once soil/groundwater sampling activities are completed, each soil boring will be properly abandoned with bentonite and the surface will be restored to match the surrounding areas.

Monitoring Well Installation and Development

Fourteen monitoring wells will be installed at the former Myrtle Beach AFB in accordance with DHEC R.61-71 South Carolina Well Standards (Effective Date: May 27, 2016) and ASL SOP-19_R1, “Monitoring Well Installation/Abandonment.” The monitoring wells will be completed within the upper groundwater zone and installed by a driller that is registered in South Carolina with the Board of Certification of the Environmental Systems Operator per the SCDHEC Well Standards and Regulations R. 61-71. The registered driller will complete Water Well Record Form 1903 and submit to SCDHEC within 30 days of the completion of the well. The total depth of the monitoring wells will be determined based on lithologic interpretations in the field and depth to groundwater. Monitoring wells will be constructed using 2-inch diameter Schedule 40 PVC flush thread riser coupled with a 10-foot, .010 machine slotted Schedule 40 PVC screen and end cap. Each new well be installed with approximately two feet of the well screen above the water table to 8 feet below the water table. The annulus will be backfilled with sand to an approximate depth of 1 foot above the top of the well screen, and a bentonite seal (a minimum of 2 feet thick) will be placed on top of the sand filter pack. A cement bentonite grout will be placed above the seal and extend to within approximately 0.5 foot of the ground surface. Each well will be completed with an 8-inch manhole flush-mount surface completion set in an approximate 2-foot-by-2-foot concrete pad. New monitoring wells will be professionally surveyed to determine location and elevation. Boring logs and monitoring well completion diagrams will be generated for each well.

A minimum of 24 hours following monitoring well installation and surface completion activities, each monitoring well will be developed to remove sediment from the well in accordance with ASL SOP-019_R2.

For existing monitoring wells to be sampled, any dedicated Teflon tubing will be removed prior to sampling following ASL SOP-002P_R2. The well will then be redeveloped as if it were a new well in accordance with ASL SOP-019_R2. Once redevelopment is complete, the well will be sampled in the same fashion as the new wells.

Wells will be developed by over-pumping until water quality parameters (temperature, specific conductance, potential of hydrogen, dissolved oxygen, and oxidation-reduction potential) have stabilized and turbidity has stabilized or is below 10 nephelometric turbidity units. Development water will be managed in accordance with ASL SOP-020_R1, “Management of Investigation Derived Waste.” Development and purge waters will be containerized in Department of Transportation-approved, 55-gallon drums, pending characterization and off-site transportation and disposal. Following completion of well development, the wells will be allowed to stabilize prior to purging and sampling.

Casing elevations will be surveyed at each monitoring well to obtain reference elevations. These data will be used for determining the potentiometric surface. Prior to initiating groundwater sampling activities, static water levels will be collected from existing and newly installed monitoring wells at each area to evaluate the direction of groundwater flow. Water level measurements will be recorded to the nearest 0.01 foot from the top of casing using an electronic water level indicator (ASL SOP-19_R1, “Monitoring Well Installation/Abandonment”).

A groundwater monitoring report will be completed using SCDHEC Form D-2110 and submitted to the SCDHEC after monitoring well installation is completed.

Groundwater Sampling

Groundwater samples will be collected from 14 newly installed, eight existing monitoring wells, and 10 direct-push locations to determine the presence or absence of PFCs within groundwater at each area. Prior to initiating groundwater sampling activities, static water levels will be collected from existing and newly installed monitoring wells at each area to evaluate direction of groundwater flow. Water level measurements will be recorded to the nearest 0.01 foot from the top of the casing in monitoring wells using an electronic water level indicator.

In the newly installed wells, water levels will be allowed to stabilize for a minimum of 24 hours prior to measurement and sampling. Wells will be purged and sampled using low flow purging and sampling techniques in accordance with ASL SOP-002P_R2, “Groundwater Sampling at Perfluorinated Compound Sites.” During the purging process, water quality parameters (potential of hydrogen [pH], specific conductance, temperature, dissolved oxygen [DO], oxidation reduction potential [ORP], and turbidity) will be measured using a water quality meter or combination of meters. Well purging will be considered complete when stabilization of water quality parameters is achieved, as indicated in ASL SOP-002P_R2. After achieving stabilization, the appropriate sample containers will be filled using direct fill sampling techniques. Purge records, water quality parameters, and sampling details will be recorded on groundwater sample forms.

Surface Water and Sediment Sampling

Nineteen surface water and sediment samples will be collected to determine the presence or absence of PFCs within the installation drainage ditches where there is the potential that a release of AFFF containing PFCs to surface water has occurred. Where present, surface water samples may be collected from any flowing or free-standing water. If surface water is not present, only sediment samples will be collected from that location. The samples will be collocated such that the sediment samples will be collected from the sediment directly below the surface water sample locations. Surface water and sediment samples will be collected in accordance with ASL SOP-004_R1, “Surface Water Sampling,” and ASL SOP-0012_R1, “Sediment Sampling.” Sample collection will be recorded in the field log and on sample collection forms.

Analytical Analysis

Environmental samples collected at the AFFF areas, will be analyzed by liquid chromatography and tandem mass spectrometry (LC-MS/MS) for the following fourteen PFCs using Analytical Method 537M:

- | | |
|------------------|--------------|
| - PFOS | - PFOA |
| - PFBS, | - PFDA, |
| - PFDoA, | - PFHpA, |
| - PFHxA, | - PFHxS, |
| - PFNA, | - PFTA, |
| - PFTTrDA, | - PFUnA, |
| - N-EtFOSAA, and | - N-MeFOSAA. |

Investigation-Derived Waste Management

Investigation-derived waste (IDW) will consist of soil cuttings from soil boring advancement, monitoring well installation and development, decontamination water, disposable personnel protective equipment (PPE), and other trash.

PPE and other trash will be placed in plastic bags and placed into sanitary trash containers and disposed of at a sanitary landfill. Soil and water IDW will be containerized in Department of Transportation-approved 55-gallon drums or larger containers as necessary pending characterization. Waste transportation and disposal services will be completed by Premier Industrial Services Group, LLC.

Waste characterization sampling is expected to consist of two waste streams:

1. composited samples of soil collected from the soil borings and
2. composited samples collected from decontamination water and well development/purge water.

Waste characterization analytical requirements for soil and waste water, as defined by the receiving disposal facility acceptance criteria, will include:

- Toxicity Characteristic Leaching Procedure analysis of
 - volatile organic compounds–EPA Method 8260B,
 - semivolatile organic compounds–EPA Method 8270D,
 - Resource Conservation and Recovery Act 8 Metals–EPA Method 6010,
 - pesticides–EPA Method 8081,
 - herbicides–EPA Method 8151,
- total polychlorinated biphenyls–EPA Method 8082,
- total petroleum hydrocarbons by EPA Method 8015D,
- flash point by EPA Method 1010A,
- pH by EPA Method 9045B,
- sulfide by EPA Method 376.2 modified, and
- cyanide by EPA Method 9010B/9014.

AFCEC will review and approve all waste profiles and disposal manifests. Upon evaluation of waste characterization results, the solid and liquid waste will be transported offsite for disposal. An ASL representative will oversee IDW loading for transport and disposal. Copies of bills of lading/manifests will be included in the site investigation report.

Water Well Survey

As part of the SI data collection process, a comprehensive water well survey will be performed to identify public or private drinking water supply wells downgradient of Myrtle Beach AFB. The survey may include database and records searches, mailing or placing door-hangers, door-to-door interviews with residents, and/or a physical survey. The comprehensive survey will initially include identification of public or private drinking water wells within 4 miles of each AFFF area.

Proposed Subcontractors

Surveying: Rowe Professional Services, Co.

Drilling: A-E Drilling Services

Laboratory: SGS Accutest

Utility Clearance: Ground Penetrating Radar Systems; Palmetto Utility Protection Service,
(South Carolina 811)

Waste Management: Premier Industrial Services

Table 2 Perfluorinated Compound Sampling Strategy and Rationale at the Former Myrtle Beach Air Force Base

AFFF Area No.	Name	Description	Approximate Groundwater Depth (bgs) and Flow Direction	Sampling Rationale	Sampling Details				
					# Borings	# Soil Samples	# Monitoring Well Installations	# Groundwater Samples	# Surface Water/Sediment Samples
1	Supply Open Storage Area 213	- Storage and handling area - Operational: 1962 - 1993 - Facility stored fire extinguishing foam - No documented releases	-	<ul style="list-style-type: none">No sampling since area only stored AFFF and is not a fire station.	--	--	--	--	--
2	Supply Open Storage Area 45202	- Storage and handling area - Operational: 1959 - 1993 - Facility stored fire extinguishing foam - No documented releases	-	<ul style="list-style-type: none">No sampling since area only stored AFFF and is not a fire station.	--	--	--	--	--
3	Building 328 (Fuels System Maintenance Dock)	- Storage area - Operational: 1970 - 1993 - Maintained an AFFF fire suppression system - No documented releases	7-12, Southeast	<ul style="list-style-type: none">Install two soil borings/monitoring wells to sample the soil and groundwater in areas where AFFF would have flowed out of the hangar doors.Sample downgradient groundwater at existing well B328-MW02 [associated with Site B324 (SWMU 40)] to capture migrating releases in the area.	2	4	2	3 Sample existing well B328-MW02	--
4	Building 355 (Corrosion Control Shop)	- Storage area - Operational: 1976 - 1993 - Maintained an AFFF fire suppression system - No documented releases	7-12, Southeast	<ul style="list-style-type: none">Install two soil borings/monitoring wells to sample the soil and groundwater in areas where AFFF would have flowed out of the hangar doors.Install and sample one new monitoring well down gradient groundwater to capture migrating releases in the area.	3	6	3	3	--
5	Building 358 (Hangar 2 - Maintenance)	- Storage and release area - Operational: 1957 - 1993 - Maintained an AFFF fire suppression system - System was activated 2-3 times per year	7-12, Southeast	<ul style="list-style-type: none">Install three soil borings/monitoring wells to sample the soil and groundwater in areas where AFFF would have flowed out of the hangar doors.	3	6	3	3	--
6	Building 359 (Hangar 3 - Maintenance)	- Storage and release area - Operational: 1957 - 1993 - Maintained an AFFF fire suppression system - System was activated 2-3 times per year	7-12, Southeast	<ul style="list-style-type: none">Install three soil borings/monitoring wells to sample the soil and groundwater in areas where AFFF would have flowed out of the hangar doors.	3	6	3	3	--
7	Building 360 (Fire Station) and Wash Rack/OWS 19	- Storage and handling area - Operational: 1956 - 1991 - Stored AFFF for transfer to fire vehicles - Maintained a fire vehicle wash rack and associated OWS - OWS discharged into nearby drainage ditches	7-12, Southeast	<ul style="list-style-type: none">Install three soil borings/monitoring wells to sample the soil and groundwater in areas where AFFF may have been release through washing or testing of fire trucks.Collect surface water and sediment at drain located directly west of the building.	3	6	3	3	1/1

AFFF Area No.	Name	Description	Approximate Groundwater Depth (bgs) and Flow Direction	Sampling Rationale	Sampling Details				
					# Borings	# Soil Samples	# Monitoring Well Installations	# Groundwater Samples	# Surface Water/Sediment Samples
8	Building 373 (Material Hangar)	- Storage area - Operational: 1986 - 1993 - Maintained an AFFF fire suppression system - No documented releases	7-12, West	<ul style="list-style-type: none">Advance two soil borings and sample the soil where AFFF would have flowed out of the hangar doors.Sample three existing monitoring wells :<ul style="list-style-type: none">Sample existing monitoring well OS40MW14 located adjacent to the hangar in the source area. This well is associated with Site B505 (SWMU 79/80).Sample groundwater at downgradient locations OS40MW12 and OS40RW5 to capture migrating releases in the area. These wells are also associated with Site B505 (SWMU 79/80).	2	4	--	3 Sample existing wells OS40MW12, OS40MW14, and OS40RW5	--
9	Drainage Ditches and Sluice Gate	- Release area - Operational: 1940 - 1993 - Transported wastewater from buildings and flightline to Intracoastal Waterway and Atlantic Ocean - Sluice gate installed southwest of Building 328 to contain AFFF discharged from fire suppression systems at Bldgs. 358 and 359	N/A	<ul style="list-style-type: none">Collect 11 surface water and sediment samples in base-wide ditches that drain the flightline and apron hangars.Collect 5 surface water and sediment at locations where main ditches leave the former installation boundary.Collect 2 surface water and sediment samples at the sluice gate.Sample existing wells MB-19 and MB-21 [associated with Site B324 (SWMU 40)] located adjacent to and downgradient of the sluice gate to capture migrating releases in the area.	--	--	--	2 Sample existing wells MB-19 and MB-21	18/18
10	Flightline	- Release area - Operational: 1940 - 1993 - Used for fire training exercises that may have involved the use of AFFF .	7-12, Varies	<ul style="list-style-type: none">Advance 10 DPT borings along the flightline where AFFF may been used for fire training exercises.Collect soil and groundwater samples in runoff areas on east and west sides of the runways.Sample existing wells MB-16 and MB-38 [associated with Site B324 (SWMU 40)] on the southwest side of the runway to evaluate downgradient migration.	10	20	--	12 Sample existing wells MB-16 and MB-38	
TOTAL					26	52	14	32	19/19

N/A = not applicable
PFCs = perfluorinated compounds
AFFF = aqueous film forming foam
ASL = Aerostar SES LLC
bgs = below ground surface
FTA = fire training area

QAPP Worksheet #18: Sampling Locations and Methods

The following worksheet identifies each sample proposed to be collected during this field effort necessary to meet the DQOs presented in Worksheet #11. Each sample location has a unique Station Identification (ID) and each sample has a unique Sample ID.

Station IDs indicate the physical location for each sample. Quality assurance/quality control samples and groundwater samples proposed to be collected from existing wells already have Station IDs obtained from the Environmental Restoration Program Information Management System. All new Station IDs for this project have nine characters.

MYBPMW001 – the first four characters identify the installation and the PFC project.

MYBPMW001 – the next two characters identify the type of sample (MW = monitoring well, SB = soil boring, SX = surface water/sediment, DP = direct push technology).

MYBPMW001 – the final three characters represent the consecutive station type number.

Sample IDs also consist of nine characters.

MYBP01001 – the first four characters identify the installation and the PFC project

MYBP01001 – the next two characters identify the type/location of sample (01 = AFFF Area 1, XX = samples collected in areas other than identified AFFF areas such as boundary wells, etc.).

MYBP01001 – the last three characters represent the consecutive sample number

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
3	MYBPMW001	MYBP03001	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW001	MYBP03002	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW001	MYBP03003	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPMW002	MYBP03004	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW002	MYBP03005	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW002	MYBP03006	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	B328-MW02	MYBP03007	N	WG	29.3/39.3	Submersible or actuating pump	Existing	Downgradient

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
4	MYBPMW003	MYBP04008	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW003	MYBP04009	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW003	MYBP04010	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPMW004	MYBP04011	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Downgradient
	MYBPMW004	MYBP04012	N	SO	0-2	Hand Auger	New	Downgradient
	MYBPMW004	MYBP04013	N	SO	8-10	Hollow Stem Auger	New	Downgradient
	MYBPMW005	MYBP04014	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW005	MYBP04015	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW005	MYBP04016	N	SO	8-10	Hollow Stem Auger	New	Source area sample
5	MYBPMW006	MYBP05017	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW006	MYBP05018	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW006	MYBP05019	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPMW007	MYBP05020	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW007	MYBP05021	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW007	MYBP05022	N	SO	8-10	Hollow Stem Auger	New	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

APFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
5	MYBPMW008	MYBP05023	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW008	MYBP05024	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW008	MYBP05025	N	SO	8-10	Hollow Stem Auger	New	Source area sample
6	MYBPMW009	MYBP06026	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW009	MYBP06027	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW009	MYBP06028	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPMW010	MYBP06029	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW010	MYBP06030	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW010	MYBP06031	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPMW011	MYBP06032	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW011	MYBP06033	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW011	MYBP06034	N	SO	8-10	Hollow Stem Auger	New	Source area sample
7	MYBPMW012	MYBP07035	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW012	MYBP07036	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW012	MYBP07037	N	SO	8-10	Hollow Stem Auger	New	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
Site Inspection of PFC Release Areas at Multiple BRAC Installations
Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
7	MYBPMW013	MYBP07038	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW013	MYBP07039	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW013	MYBP07040	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPMW014	MYBP07041	N	WG	TBD (screened 10 feet across the water table)	Submersible or actuating pump	New	Source area sample
	MYBPMW014	MYBP07042	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPMW014	MYBP07043	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPSX001	MYBP07044	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX001	MYBP07045	N	SE	0-0.5	Grab	Existing	Source area sample
8	OS40MW12	MYBP08046	N	WG	30.19-40.16	Submersible or actuating pump	Existing	Downgradient
	OS40MW14	MYBP08047	N	WG	25-35	Submersible or actuating pump	Existing	Downgradient
	OS40RW5	MYBP08048	N	WG	27.2-42.2	Submersible or actuating pump	Existing	Downgradient
	MYBPSB001	MYBP08049	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPSB001	MYBP08050	N	SO	8-10	Hollow Stem Auger	New	Source area sample
	MYBPSB002	MYBP08051	N	SO	0-2	Hand Auger	New	Source area sample
	MYBPSB002	MYBP08052	N	SO	8-10	Hollow Stem Auger	New	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
9	MB-19	MYBP09053	N	WG	29.79-39.81	Submersible or actuating pump	Existing	Source area sample
	MB-21	MYBP09054	N	WG	26.5-36.48	Submersible or actuating pump	Existing	Source area sample
	MYBPSX002	MYBP09055	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX002	MYBP09056	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX003	MYBP09057	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX003	MYBP09058	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX004	MYBP09059	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX004	MYBP09060	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX005	MYBP09061	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX005	MYBP09062	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX006	MYBP09063	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX006	MYBP09064	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX007	MYBP09065	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX007	MYBP09066	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX008	MYBP09067	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX008	MYBP09068	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX009	MYBP09069	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX009	MYBP09070	N	SE	0-0.5	Grab	Existing	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
9	MYBPSX010	MYBP09071	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX010	MYBP09072	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX011	MYBP09073	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX011	MYBP09074	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX012	MYBP09075	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX012	MYBP09076	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX013	MYBP09077	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX013	MYBP09078	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX014	MYBP09079	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX014	MYBP09080	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX015	MYBP09081	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX015	MYBP09082	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX016	MYBP09083	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX016	MYBP09084	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX017	MYBP09085	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX017	MYBP09086	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX018	MYBP09087	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX018	MYBP09088	N	SE	0-0.5	Grab	Existing	Source area sample
	MYBPSX019	MYBP09089	N	WS	0-0.5	Grab	Existing	Source area sample
	MYBPSX019	MYBP09090	N	SE	0-0.5	Grab	Existing	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
10	MYBPDP001	MYBP10091	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP001	MYBP10092	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP001	MYBP10093	N	SO	8-10	DPT	New	Source area sample
	MYBPDP002	MYBP10094	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP002	MYBP10095	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP002	MYBP10096	N	SO	8-10	DPT	New	Source area sample
	MYBPDP003	MYBP10097	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP003	MYBP10098	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP003	MYBP10099	N	SO	8-10	DPT	New	Source area sample
	MYBPDP004	MYBP10100	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP004	MYBP10101	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP004	MYBP10102	N	SO	8-10	DPT	New	Source area sample
	MYBPDP005	MYBP10103	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP005	MYBP10104	N	SO	0-2	Hand auger	New	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
Site Inspection of PFC Release Areas at Multiple BRAC Installations
Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
10	MYBPDP005	MYBP10105	N	SO	8-10	DPT	New	Source area sample
	MYBPDP006	MYBP10106	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP006	MYBP10107	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP006	MYBP10108	N	SO	8-10	DPT	New	Source area sample
	MYBPDP007	MYBP10109	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP007	MYBP10110	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP007	MYBP10111	N	SO	8-10	DPT	New	Source area sample
	MYBPDP008	MYBP10112	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP008	MYBP10113	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP008	MYBP10114	N	SO	8-10	DPT	New	Source area sample
	MYBPDP009	MYBP10115	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP009	MYBP10116	N	SO	0-2	Hand auger	New	Source area sample
	MYBPDP009	MYBP10117	N	SO	8-10	DPT	New	Source area sample
	MYBPDP010	MYBP10118	N	WG	TBD (screened 10 feet across the water table)	DPT	New	Source area sample
	MYBPDP010	MYBP10119	N	SO	0-2	Hand auger	New	Source area sample

Installation-Specific Uniform Federal Policy – Quality Assurance Project Plan Addendum
 Site Inspection of PFC Release Areas at Multiple BRAC Installations
 Former Myrtle Beach Air Force Base

AFFF Area ¹	Station ID ²	Sample ID ³	Sample Type ⁴	Matrix ⁵	Start/End Depth, ft ^a bgs ^b	Method	New or Existing Location	Rationale
10	MYBPDP010	MYBP10120	N	SO	8-10	DPT	New	Source area sample
	MB-16	MYBP10121	N	WG	29.06-39.08	Submersible or actuating pump	Existing	Source area sample
	MB-38	MYBP10122	N	WG	25-35	Submersible or actuating pump	Existing	Source area sample

¹AFFF Area – Denotes a distinct facility or area with the potential to have PFC contamination as a result of AFFF storage, use, or handling.

²Station ID – Denotes a specific, unique location at which a sample was collected.

³Sample ID – A unique identifier that attached to a sample for the purpose of documentation and tracking.

⁴Sample Type – Codifies the intended use for a particular sample: N=Normal

⁵Matrix – Codifies the sample medium: (WG=Groundwater, SO=Soil, WS=Surface Water, SE=Surface Sediment)

AFFF = aqueous film forming foam

bgs = below ground surface

DPT = direct push technology

ft = feet

ID = identification

TBD = to be determined

QAPP Worksheet #19 & 30: Sample Containers, Preservation, and Hold Times

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of Potential PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #20: Field QC Summary
Field QC Summary

Site	Matrix	Analytes	Regular Samples	Field Duplicates (1:10)	Field Blanks (1 per lot of PFC free water)	Equipment Rinsates (1:10 per piece of equipment)	MS/MSDs (1:20)	Total Samples
Myrtle Beach AFB	Soil	PFCs	52	6	0	6	3/3	70
	Groundwater	PFCs	32	4	0	4	2/2	44
	Surface water	PFCs	19	2	0	2	1/1	25
	Sediment	PFCs	19	2	0	2	1/1	25
	Lab supplied water	PFCs	0	0	1	0	0	1
	Totals		122	14	1	14	14	165

AFB = Air Force Base

QC = quality control

MS = matrix spike

MSD = matrix spike duplicate

PFCs = perfluorinated compounds

QAPP Worksheet #21: Field SOPs

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #22: Field Equipment Calibration, Maintenance, Testing, and Inspection

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #23: Analytical SOPs

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #24: Analytical Instrument Calibration

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #25: Analytical Instrument and Equipment Maintenance, Testing, and Inspection

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #26 & 27: Sample Handling, Custody, and Disposal

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #28: Analytical Quality Control and Corrective Action

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #29: Project Documents and Records

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #31, 32 & 33: Assessments and Corrective Action

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #34: Data Verification and Validation Inputs

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #35: Data Verification Procedures

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #36: Data Validation Procedures

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

QAPP Worksheet #37: Data Usability Assessment

Please refer to the general UFP-QAPP within the *QPP for Site Inspection of PFC Release Areas at Multiple BRAC Installations* (ASL, May 2016).

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FIGURES

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Legend


 Former Myrtle Beach Installation Boundary

Figure 1
Installation Location Map
Former Myrtle Beach AFB



Figure 1 Site Location Regional Myrtle Beach.mxd

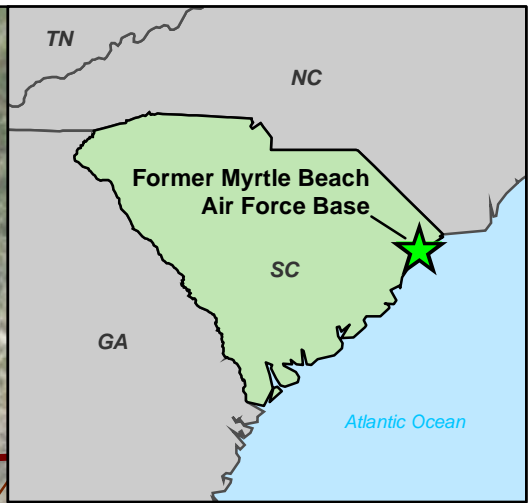
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Date: 10/13/2016

Service Layer Credits: Esri ArcGIS Online Aerial Photography

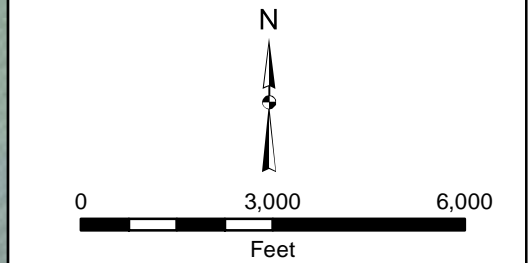
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G:\M3010_0019_0017_05_PFC\Myrtle Beach\AES_Products\MXD\Figure 2 Site Overview Map Myrtle Beach.mxd



- Legend**
- Water Well
 - Fire Training Area
 - Installation Boundary
 - AFFF Area Boundary
 - Identified in PA as Potential AFFF Area. However, additional information indicated no AFFF release.
 - Drainage Basin Boundary*
 - Approximate Groundwater Flow Direction

* Drainage basin boundary data source:
U.S. Department of Agriculture, Natural Resources Conservation Service



Former Myrtle Beach AFB
Horry County, South Carolina

Figure 2
Installation Overview Map
and AFFF Areas
Former Myrtle Beach Air Force Base

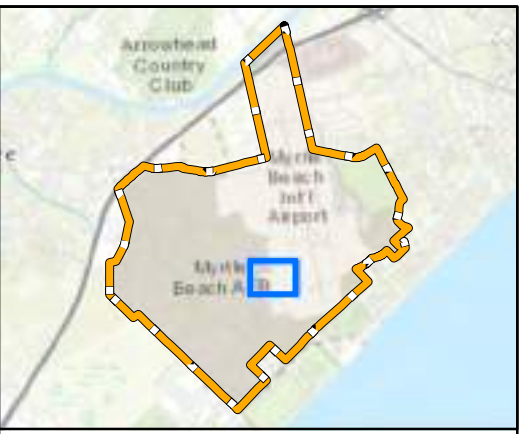
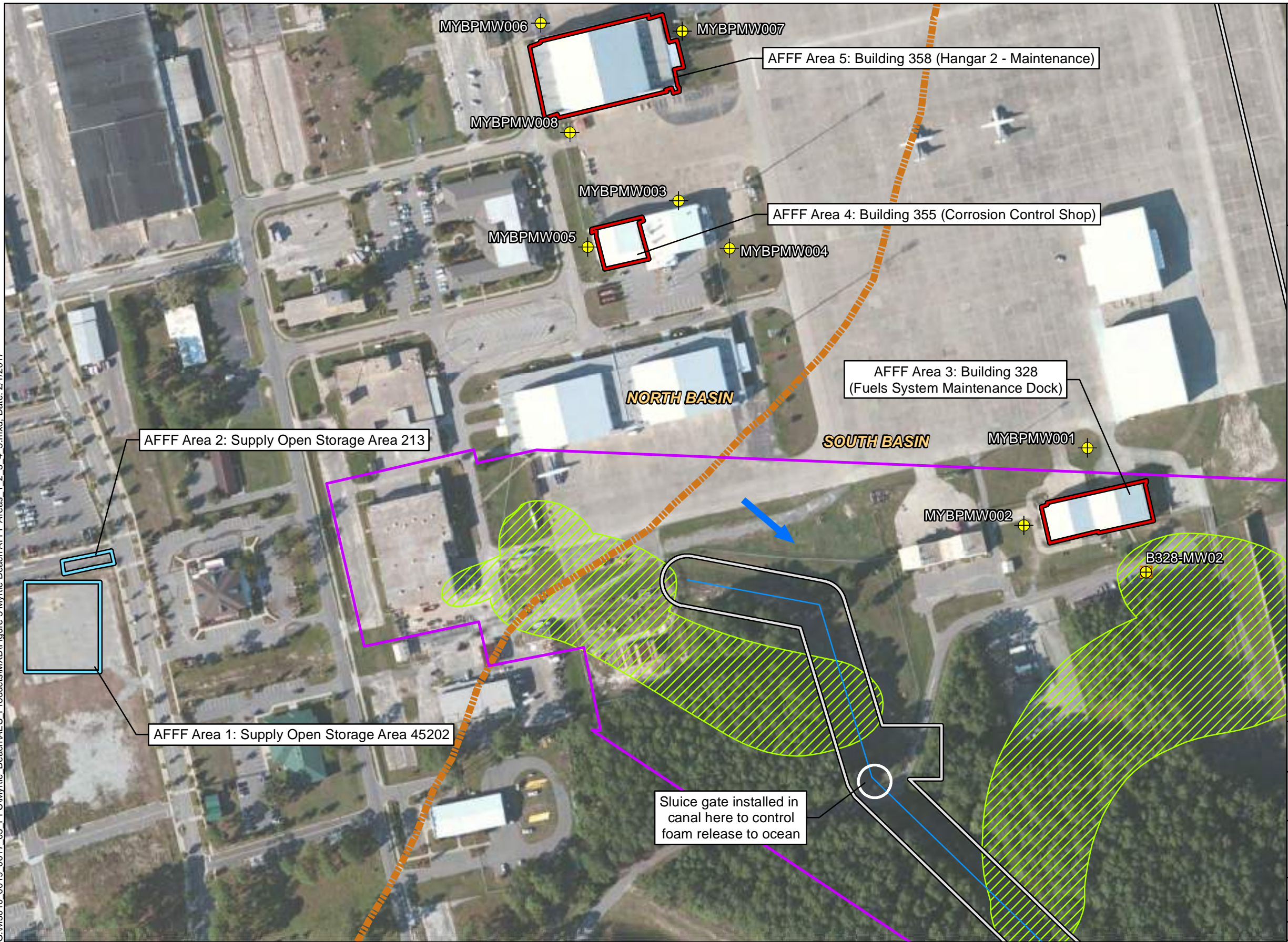


Figure 2 Site Overview Map Myrtle Beach.mxd
Drawn: A Whitlock/Ackerman Date: 12/2/2016
Service Layer Credits: Esri ArcGIS Online Aerial Photography

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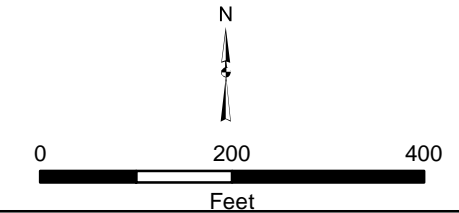
G:\M3010_0019_0017_05_PFC\Myrtle Beach\AES_Products\MXD\Figure 3 Myrtle Beach AFFF Areas 1 2 3 4 5.mxd; Date: 2/1/2017

Well to be Sampled
Well and Soil
Boundary*
Area - Building 324
d 5
Potential AFFF Area.
Information
Release.
**



- Legend**
- Existing Monitoring Well to be Sampled
 - Proposed Monitoring Well and Soil Boring
 - Drainage Ditch
 - Drainage Basin Boundary*
 - Land Use Control Area - Building 324 (SWMU 40)
 - Installation Boundary
 - AFFF Areas 3, 4, and 5
 - Other AFFF
 - Identified in PA as Potential AFFF Area.
 - However, additional information indicated no AFFF release.
 - VOC Plume Extents **
 - Approximate Groundwater Flow Direction

* Drainage basin boundary data source:
U.S. Department of Agriculture, Natural Resources
Conservation Service
** VOC Plume data obtained from CB&I Federal
Services LLC



Former Myrtle Beach AFB

Figure 3
AFFF Areas 1, 2, 3, 4, and 5
Proposed Sample Locations



Figure 3 Myrtle Beach AFFF Areas 1 2 3 4 5.mxd

Drawn: B Owens

Date: 2/1/2017

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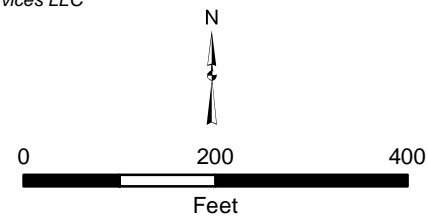
G:\M3010_0019_0017_05_PFC\Myrtle Beach\AES_Products\MXD\Figure 4 Myrtle Beach AFFF Areas 6 7 8.mxd Date: 2/1/2017



- Legend**
- Existing Monitoring Well to be Sampled
 - Monitoring Well and Soil Boring
 - Soil Boring
 - Surface Water and Sediment Sample
 - Drainage Basin Boundary*
 - Land Use Control Area - Building 505 (SWMU 79/80)
 - AFFF Areas 6, 7, and 8
 - Other AFFF Area
 - AFFF Area Linear Feature (Drainage Ditch)
 - VOC Plume Extents **
 - Installation Boundary
 - Approximate Groundwater Flow Direction

* Drainage basin boundary data source:
U.S. Department of Agriculture, Natural Resources Conservation Service

** VOC Plume data obtained from CB&I Federal Services LLC



Former Myrtle Beach AFB

Figure 4
AFFF Areas 6, 7, and 8
Proposed Sample Locations



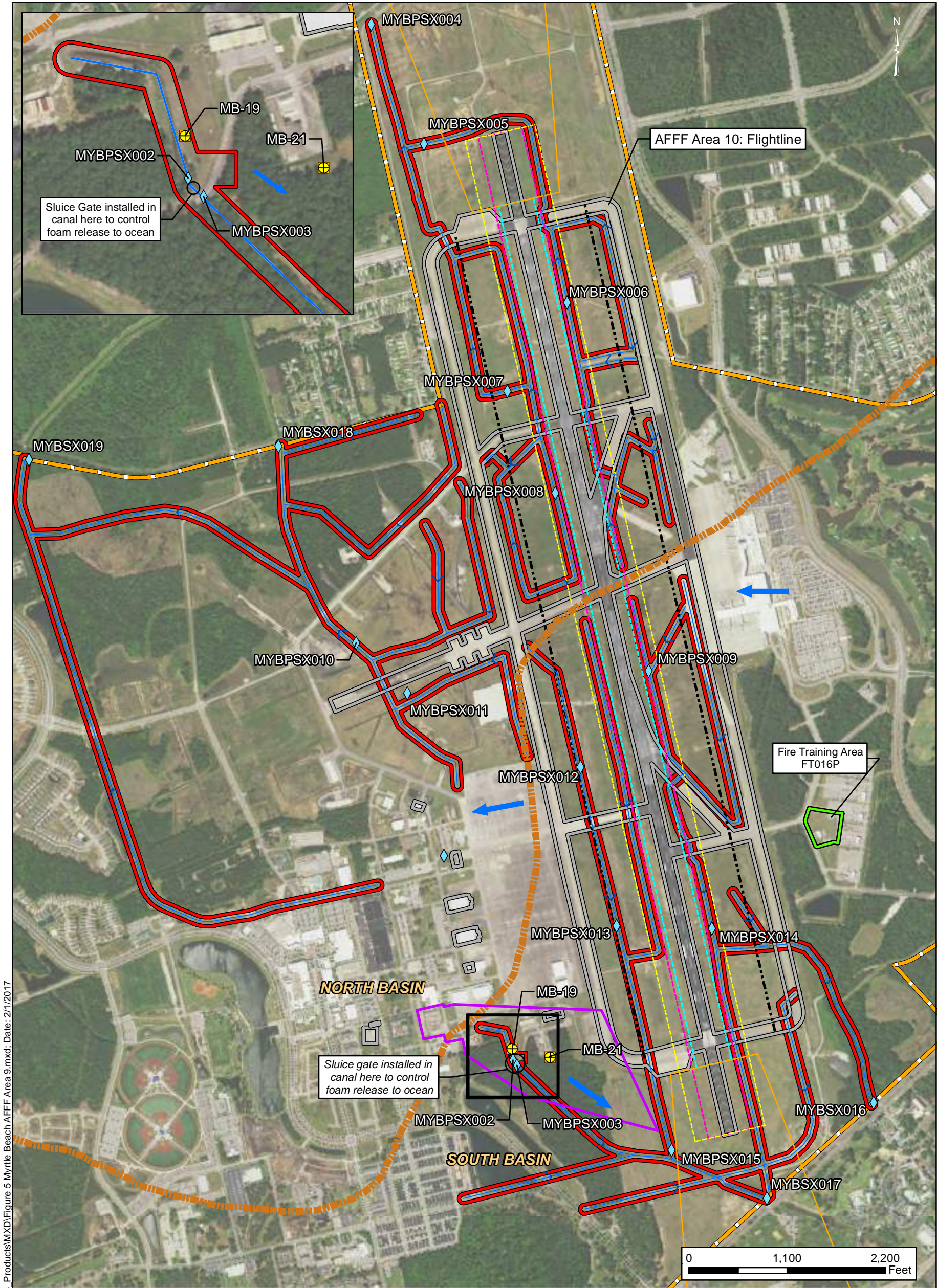
Figure 4 Myrtle Beach AFFF Areas 6 7 8.mxd

Drawn: B Owens

Date: 2/1/2017

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G:\M3010_0019_0017_05_PEC\Myrtle Beach\AES_Products\MXD\Figure 5 Myrtle Beach AFFF Area 9.mxd; Date: 2/1/2017



Legend

◆ Proposed Surface Water and Sediment Sample	■ Fire Training Area
⊕ Existing Monitoring Well to be Sampled	— Myrtle Beach International Airport - RPZ
□ Land Use Control Area - Building 324 (SWMU 40)	— Myrtle Beach International Airport - BRL
— Drainage Basin Boundary*	— Myrtle Beach International Airport - OFZ
— Drainage Ditch w/ Flow Direction (1992 Baseline Survey)	— Myrtle Beach International Airport - ROFA
■ AFFF Area 9	— Myrtle Beach International Airport - RSA
□ Other AFFF	← Approximate Groundwater Flow Direction
— Installation Boundary	

* Drainage basin boundary data source: U.S. Department of Agriculture, Natural Resources Conservation Service

Former Myrtle Beach AFB

Figure 5
AFFF Area 9: Drainage Ditches and Sluice Gate
Proposed Sample Locations

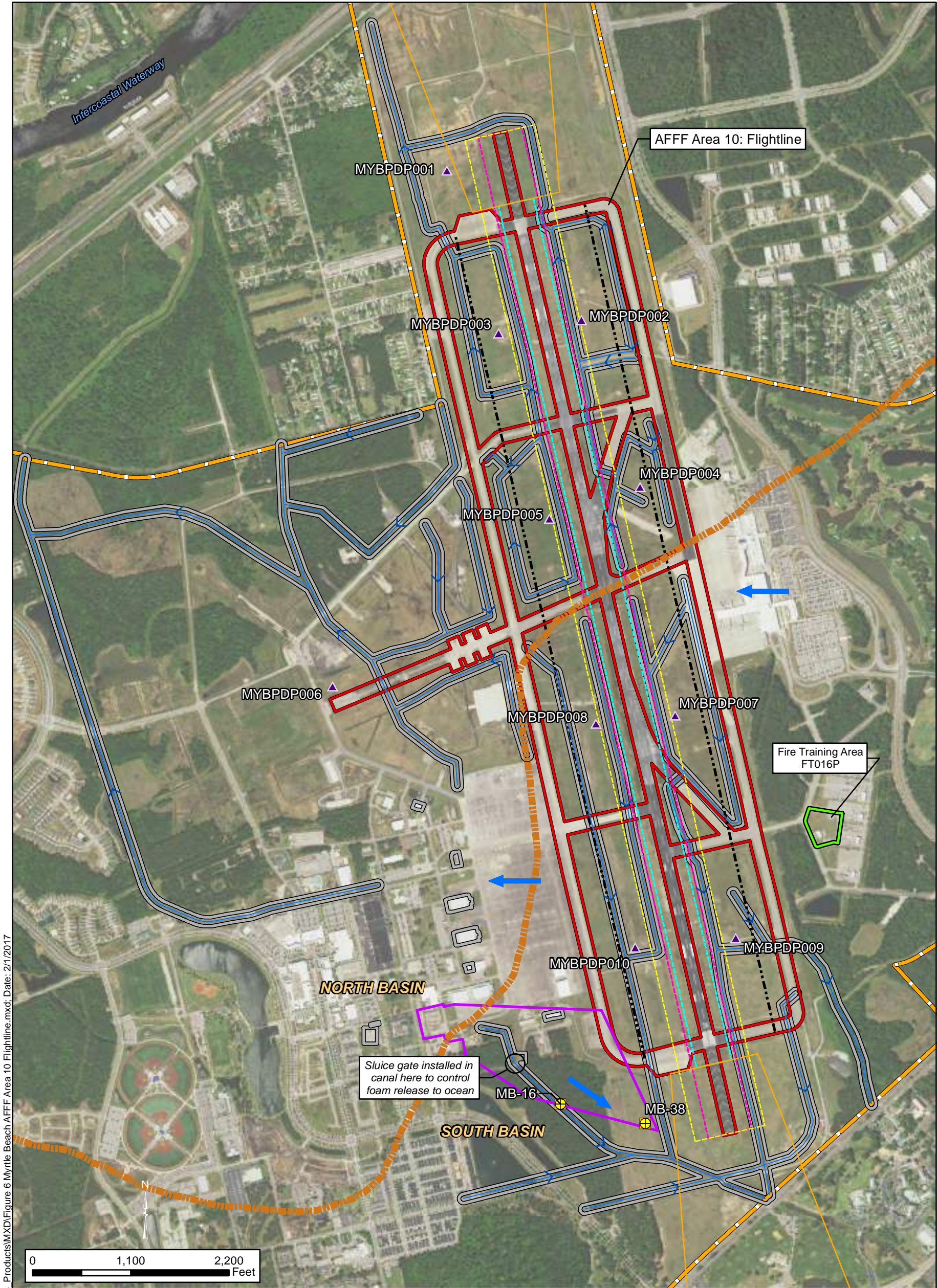


Figure 5 Myrtle Beach AFFF Area 9.mxd

Drawn: B Baxter, A Whitlock	Date: 2/1/2017
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G:\M3010_0019_0017_05_PEC\Myrtle Beach\AES_Products\MXD\Figure 6 Myrtle Beach AFFF Area 10 Flightline.mxd; Date: 2/1/2017



Legend

▲ Proposed Groundwater and Soil DPT Boring	■ Fire Training
● Existing Monitoring Well to be Sampled	■ Installation Boundary
■ Drainage Basin Boundary*	— Myrtle Beach International Airport - RPZ
■ Land Use Control Area - Building 324 (SWMU 40)	— Myrtle Beach International Airport - BRL
→ Drainage Ditch w/ Flow Direction (1992 Baseline Survey)	— Myrtle Beach International Airport - OFZ
■ AFFF Area 10 Area	— Myrtle Beach International Airport - ROFA
■ Other AFFF	— Myrtle Beach International Airport - RSA
	→ Approximate Groundwater Flow Direction

* Drainage basin boundary data source: U.S. Department of Agriculture, Natural Resources Conservation Service

Former Myrtle Beach AFB

Figure 6
AFFF Area 10: Flightline
Proposed Sample Locations

Figure 6 Myrtle Beach AFFF Area 10 Flightline.mxd

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APPENDIX A

Installation-Specific Health and Safety Considerations

The installation-specific health and safety considerations provided in this appendix supplement the General HSP included as Appendix A to the QPP. Refer to the HSP and QPP for all activity hazard analyses, site control requirements, personal protective equipment needs, safety mitigation measures, and standard operating procedures.

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Installation-Specific Health and Safety Considerations

Site: Former Myrtle Beach Air Force Base, California

Prepared By: Allison Bailey

Date: February 10, 2017

Reviewed By: _____

Date: _____

Dates of Required Training and Medical Surveillance¹:

Name	Tim Cullen	Tyler Bowling	Allison Bailey
Job Duties	Field Team Lead/HSO	Field Team	Project Manager
First Aid	06/21/2016	06/03/2016	N/A
CPR	06/23/2016	06/03/2016	N/A
Hazard Communication	02/28/2014	04/28/2016	N/A
HAZWOPER	12/07/2016	05/02/2016	N/A

¹At least one worker must be trained in First Aid/CPR and should receive bloodborne pathogen training. Required for Field Lead and Site Health and Safety Officer. Dates will be provided before field effort.

HSO = Health and Safety Officer CPR = cardiopulmonary resuscitation

HAZWOPER = Hazardous Waste Operations and Emergency Response

N/A = not applicable

Known or Suspected Contaminants

Contaminants of Potential Concern (COPC)	Maximum Concentrations:		PEL/ TLV	AFFF Areas Affected
	Soil (mg/kg)	Water/ Groundwater (µg/L)*		
Perfluorooctanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorooctanesulfonic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorobutyric Acid	Unknown	Unknown	N/A	All Suspected
Perfluorobutanesulfonic Acid	Unknown	Unknown	N/A	All Suspected
Perfluoropentanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorohexanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorohexanesulfonic Acid	Unknown	Unknown	N/A	All Suspected
Perfluoroheptanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorooctanesulfonamide	Unknown	Unknown	N/A	All Suspected
Perfluorononanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorodecanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorodecanesulfonic Acid	Unknown	Unknown	N/A	All Suspected
Perfluoroundecanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorododecanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorotridecanoic Acid	Unknown	Unknown	N/A	All Suspected
Perfluorotetradecanoic Acid	Unknown	Unknown	N/A	All Suspected
2-Methylnaphthalene	Unknown	Unknown	0.5 ppm	10
1,2,4-Trimethylbenzene	Unknown	Unknown	25 ppm	10
1,3,5-Trimethylbenzene	Unknown	Unknown	25 ppm	10
Benzene	Unknown	Unknown	1 ppm	8,10
cis 1,2-Dichloroethene	Unknown	Unknown	100 ppm	3, 8
Ethylbenzene	Unknown	Unknown	100 ppm	8,10
Naphthalene	Unknown	Unknown	2 ppm	8, 10

Contaminants of Potential Concern (COPC)	Maximum Concentrations:		PEL/ TLV	AFFF Areas Affected
	Soil (mg/kg)	Water/ Groundwater (µg/L)*		
Toluene	Unknown	Unknown	200 ppm	8,10
Trichloroethelene (TCE)	Unknown	Unknown	50 ppm	3, 8
Vinyl Chloride	Unknown	Unknown	1 ppm	3, 8
Xylenes	Unknown	Unknown	100 ppm	8,10

µg/L = micrograms per liter

COPC = contaminant of potential concern

PEL = permissible exposure limits

AFFF = aqueous film forming foam

mg/kg = milligrams per kilogram

ppm = parts per million

N/A = not applicable

TLV = threshold limit value

A.1 EXPOSURE MONITORING

Assessment of airborne chemical concentrations will be performed during the project to ensure that exposures do not exceed acceptable levels. It is not anticipated that site workers will be exposed to contaminants above established action levels. Table A-1 outlines the ASL exposure monitoring approach to be implemented for this project.

Table A-1 Direct Reading Air Monitoring Specifications

Instrument	Tasks	Action Levels^a	Action to Be Taken when Action Level Reached	Frequency^b	Calibration
PID: MultiRAE portable multi-gas monitor with 11.7 eV lamp or equivalent	All soil-intrusive and contaminated soil and groundwater handling and exposure activities	Up to 0.5 ppm 0.5–1.0 ppm 1.0–2.5 ppm 2.5–5 ppm > 5 ppm	Level D Level D collect benzene tube, vinyl chloride tube; associated action levels below not exceeded Level D collect benzene tube, vinyl chloride tube; associated action levels below not exceeded Level D collect benzene tube, vinyl chloride tube; associated action levels below not exceeded Level C: Stop work and contact CIH	Initially and periodically during tasks	Daily
Wet Bulb Globe Thermometer	During drilling and sampling activities	See Table 8-1	Reduction in work to rest periods when temperatures increase.	Initially and periodically during tasks	Daily
Noise-Level Monitor ^c:	Will be used during operation of drilling equipment to establish hearing protection required for work zone boundaries to protect workers and the public	<85 dBA 85–105 dBA	No action required Hearing protection required (NRR 32). Stop and reevaluate periodically. Ear plugs with a minimum NRR of 32 dB will be worn for all exposures > 85 dBA.	Initially and periodically during task	Daily
		>105 dBA	Establish the use of administrative controls in the form of noise control barriers and zones for controlling noise exposures as described in Section 9.j. of the APP. In addition, double hearing protection (ear plugs with NRR 32 dB plus ear muffs) will be worn for noise exposures >105 dBA.		

^a Action levels apply to sustained breathing-zone measurements above background.

^b The exact frequency of monitoring depends on field conditions and is to be determined by the Site Safety and Health Officer; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate.

^c Noise monitor used for establishing PPE control zones for workers and the public

^d When double hearing protection is required (noise greater than 105 dBA), affected employees will switch from ANSI Z87.1-2010 standard safety glasses with side shields to safety goggles that meet the requirements of ANSI Z87.1-2010, where the elastic strap can be worn over the exterior of the ear muff rather than the stem of the safety glasses breaking the seal of the ear muffs.

> = greater than

APP = accident prevention plan

dB = decibel

eV = electron volt

NRR = noise reduction rating

ppm = parts per million

< = less than

CIH = Certified Industrial Hygienist

dBA = A-weighted decibels

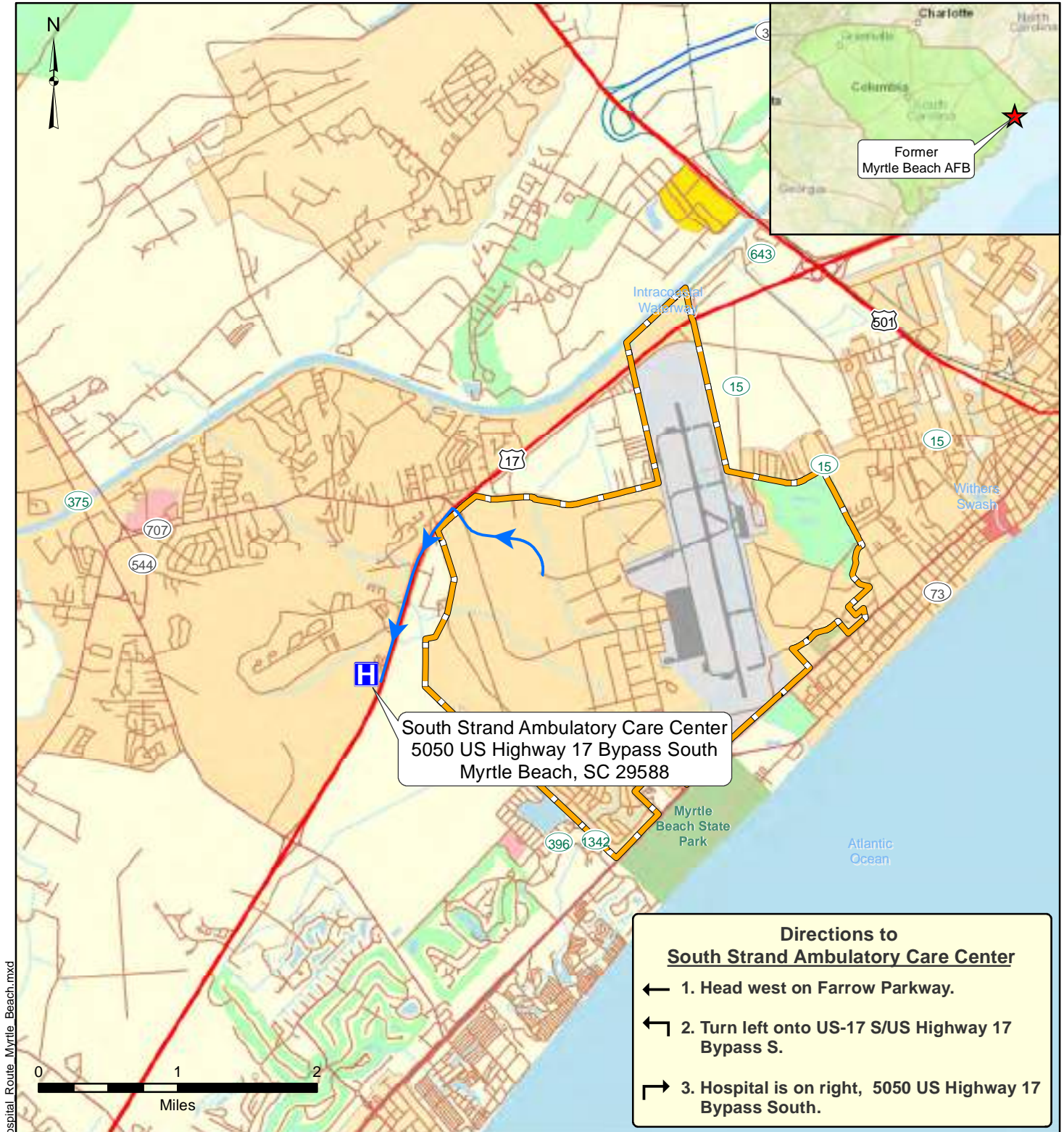
mg/m³ = milligrams per cubic meter

PID = photoionization detector

Emergency Contacts

Name	Telephone Numbers		Date of Pre-Emergency Notification (if applicable)
Hospital: South Strand Ambulatory Care Center 5050 US Highway 17 Bypass South, Myrtle Beach, SC 29588	(843) 839-1000		
Myrtle Beach Fire Department:	911 or (843) 238-3641		
Myrtle Beach Police Department	(843)626-9589		
South Carolina Department of Natural Resources Nuisance Alligator Reporting	(803)734-3886		
Horry County Department of Airports Economic Development Director Ryan Betcher	(843) 448-1580		
Aircraft Rescue and Firefighting Facility Chief/Safety Training Manager Peter DeGruccio	(843)238-3231		
Director of Airport Development Dan Pruim	(843) 907-3907		
Myrtle Beach International Airport	(843) 448-1589		
Myrtle Beach International Airport Security	(843)448-6953		
Client Contracting Officer Representative: Jason Rose	(210) 395-9423		
Myrtle Beach POC: Catherine Jerrard	(315) 356-0810		
Program Manager: Paula Bond	Office:(865) 813-2759	Cell: (865) 309-9996	
Project Manager: Allison Bailey	Office: (865) 483-9280	Cell: (865) 696-8331	
Site Health and Safety Officer: Tim Cullen	Office: (904) 565-2820	Cell: (904) 718-0679	
Group Health and Safety Manager: Richard Rathnow	Office: (865) 813-2747	Cell: (865) 607-2197	

POC = point of contact



Legend

- Medical Facility
- Hospital Route
- Former Myrtle Beach Installation Boundary

**Figure A-1
Hospital Route Map
Former Myrtle Beach AFB**



Fig A-1 Hospital_Route_Myrtle_Beach.mxd

Drawn:jowens

Date: 9/6/2016

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